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GAS LIGHT JOURNAL.

(ILLUSTRATED.)

DEVOTED TO THE INTERESTS OF

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AND

GENERAL SCIENCE.

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[NOTICE.]

Wrinkle Department, American Gas Institute.

WRINKLE DEPARTMENT, AMERICAN GAS INSTITUTE,
OFFICE OF EDITOR, GAS OFFICE BUILDING,
DETROIT MICH, March 12th, 1909.

To the Members, American Gas Institute: All members of the American Gas Institute are earnestly requested to forward contributions for the Wrinkle Department as soon as possible.

Your co-operation determines the success of the Department.

F. L. CROSS, Editor.

OUR SEMI-CENTENNIAL NUMBER.

Sufficient progress has been made in getting up our Semi-Centennial Number to enable us to place something definite and precise before our readers as to its magnitude. Repeating our remark of a week ago that it will exceed in value any other special number of a technical paper heretofore published, in its special applicability to the industry directly concerned, we here furnish some reasons why that belief is justified. In the first place the number will go considerably over the 100 pages originally planned, not that advertisers have "flocked in large numbers" to help us out, but that the articles secured have gone considerably beyond the space at first allotted—however, this may be truthfully termed a "good fault." So far (the evening of July 1st) the articles received number 23, and these with their titles, are appended—so far the illustrations number over 250, and the text covers 79 pages, with three articles yet to be received. Here is the list, given as nearly as possible in the order of reception:

"Uncle Jerry in Reminiscent Mood," by Mr. J. B. Howard, Galena, Ills.

"A Rapid Review of the Gas Industry in New York City," by Dr. A. H. Elliot, New York City.

"Some Processes I Have Known," by Mr. F. Egner, Norfolk, Va.

"Public Utilities Commissions," by Mr. R. C. Dawes, Chicago.

"Developments in the Commercial Division of the Gas Industry during the Past Fifty Years," by Mr. Philmer Eves, Indianapolis.

"Meters and Meter Makers," by Mr. Donald McDonald, Albany, N. Y.

"A Half Century's History of the Gas Industry on the Pacific Coast," by Mr. John A. Britton, San Francisco, Cal.

"Fifty Years' Progress in the Gas Industry of Canada," by Mr. W. H. Pearson, Toronto, Ont.

"Fifty Years of Street Lighting in and around New York," by Mr. H. Thurston Owens, New York.

"Gas Association Work in the United States," by Mr. George G. Ramsdell, New York.

"The Gas Coals of America," by Mr. Jas. D. Perkins, New York.

"Progress of the Gas Industry of Great Britain during the Past Fifty Years," by Mr. Norton H. Humphrys, Salisbury, England.

"Four Men Whose Work in Fraternizing the Gas Industry was of Exceeding Value," by Mr. Arthur E. Boardman, Brevard, N. C.

"History of Water Gas," by Mr. F. N. Morton, Philadelphia, Pa.

"Growth and Value of Demonstration Work," by Mrs. Helen Armstrong, Chicago.

"The Development of the Ammonia Industry in Gas Works during the Last Fifty Years," by Mr. R. W. Hilgenstock, Pforzheim, Germany.

"History of Gaseous Fuel as Applied to Heating Retorts," by Mr. F. Bredel, Milwaukee, Wis.

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"History of Vertical Retorts," by Mr. Fred. Mayer, New York.
"Heating Machines," by Mr. E. P. Reichhelm, Jersey City, N. J.
"Residuals," by Mr. Carroll Miller, Pittsburgh, Pa.
"Progress in Electric Current Development in the Artificial Lighting Field," by Mr. Albert F. Ganz, M.E., Stevens Inst., Technology, Hoboken, N. J.
"The Development of the Public Utilities Commissions, as applied to the Gas and Electric Business," by Mr. C. J. Russell Humphreys, Lawrence, Mass.
"History of the Gas Industry of New England in the Half Century," by Capt. W. E. McKay, Boston, Mass.

Since gold does not require gilding so that the mass may take on added value, more phrasing of ours over these authors and the themes upon which they write would be equally futile. We might, however, and we do reiterate the statement that no single number of any periodical devoted to the chronicles of the gas industry ever equaled this as to value of contents. There are the names of the writers, also the names of their themes. In view of this exceeding literary feast, it hardly seems necessary to urge upon those who wish more than one copy of our Semi-Centennial issue to send in their orders at once. We should here add that three further articles are sure to come to hand next week; but we have listed none the copy for which is not now in the hands of the editors.

BRIEFLY TOLD.

FIFTH ANNUAL MEETING, IOWA GAS ASSOCIATION.—Our advices respecting this meeting are very meager, owing to the fact that the member who agreed to report it for us was, at the last moment, obliged to reconsider his determination to be present at the sessions. Enough is to hand, however, to enable us to say that the meeting was an excellent one, quite close to 100 delegates and visitors having been in attendance. The paper list was a very lengthy one, and its numbers were attractive enough to arouse some spirited discussion. One topic for general discussion that brought out a sparkling set-to was in respect of "The Progress of the Tar Market During the Year." The gentlemen interested in the present proposed tariff clause which will admit sulphate of ammonia duty free, would do well to read this discussion, for it deals with a matter that causes to be literally dumped in America thousands of tons of foreign tar, a large part of which is brought here as ballast. The outings and "spells of leisure" were: A smoker at the Ellis Hotel (which was headquarters) the evening of June 23d, the annual banquet the evening of June 24th, winding up with a visit of inspection of Waterloo and Cedar Falls, and the baseball match, the afternoon of the 24th. The officers elected were President, George H. Waring, Omaha, Neb,; First Vice-President, Austin Burt, Waterloo; Second Vice-President, Geo. W. Clabaugh, Omaha; Secretary-Treasurer, George I. Vincent, Des Moines.

AN IMPORTANT DECISION, PUBLIC SERVICE COMMISSION, NEW YORK, SECOND DISTRICT.—Last week the Public Service Commission of the Second New York District handed down a ruling of great importance to gas distributers, which in effect declares that a gas company has no legal right to withhold the supply of gas to a consumer because the consumer has failed to install service pipes of a proper size. The question came up on the complaint of Mr. U. G. Stockwell against the Municipal Gas Company, of Albany. Complainant recently piped his house for gas, putting in 35 feet of ¾-inch pipe, off which four ¼-inch openings were made for gas jets. He also ran 66 feet of ¾-inch pipe to conduct gas solely to his gas range. The Company refused to turn on the supply of gas, claiming that the fuel run was 16 feet longer than allowed by its rules for ¾-inch pipe, and that its table also allowed only one ¼-inch opening on a 20-foot run of ¾-inch pipe. In justification of its refusal to furnish gas to Mr. Stockwell, the Company stated that it had "No interest in making these rules, except to insure that the consumer would have plenty of supply for such purposes as he might want to use the gas, and a great many of the complaints of shortage of gas and poor quality were due entirely to the fact that the old piping in the houses is entirely too small to carry the necessary amount of gas to give satisfaction to the consumer." The Commission points out that a gas corporation is bound by statute to furnish gas upon the written application of the owner or occupant of any building or premises within 100 feet of any mains laid down by it. Compliance with this legal objection is, however, subject to just such just and proper regulations as the company might adopt as a means of securing payment for its gas and safety in its supply. In the case before the Commission, the Company had refused to supply the gas because, in its opinion, the complainant's premises were not piped so as to give the best results. This, says the Commission, is the consumer's lookout. If the consumer is content, especially after he is warned, with an inferior illumination, it is not for the Company to say that he must have the best. And if the premises are piped so as to insure safety of the supply and accurate measurement of the gas used, the Company is without sufficient legal excuse in withholding the supply.

THE TARIFF AND GAS LIGHTING.—The Senate has voted upon two matters which are of interest to the gas fraternity, which things, if passed finally to enactment, will cause foreign sulphate of ammonia to come in free, and the duty on thorium nitrate will be increased from 25 to 60 per cent., while the duty on foreign mantles will be increased from 20 to 60 per cent. As this is not final, in that this action will be reviewed by the joint committee of the Senate and House, there is still time for gas companies to protest, as they assuredly will do. We have seen the results of free tar, which has been dubbed by gas men as the pauper tar of Europe, brought over as ballast and dumped upon our shores. Shall this be repeated with sulphate of ammonia? The increased duty on thorium nitrate will necessitate an increase in the price of American made mantles; and, further, the prohibitive duty on foreign mantles will allow the American manufacturers to certainly control the American rate of sale for these. With thorium at 25 per cent. and mantles at 20 per cent., the American mantle manufacturer can pay American wages and readily compete with the foreign article, so, "What infant industry is at stake?" And who will be gainer? Certainly not the gas company in relation to its dealings with its consumers.

CURRENT MENTION.—

MR. CHARLES F. CATTELL, General Manager of the Parkesburg Gas Company, of West Chester, Pa., writing under date of the 26th ult.—and right glad we are to hear from the estimable gentleman—says: Dear JOURNAL: I am inclosing prospectus and views of the Parkesburg Gas Company, the buildings of which are finished. The dimensions of the structures are:

Generator house... 36 feet by 24 feet by 20 feet high to eaves.
Boiler house ... ... 24 feet by 18 feet by 15 feet " "
Purifying house... 24 feet by 24 feet by 24 feet " "

All the walls are 13-inch, with iron trussed roofs. The site is really ideal. We have an elevator, and at the rear of our plot runs a good stream of water, the composition of which is just right. A new generating set, 6 feet in diameter, of the Phœnix Gas Improvement Company, will be on the ground the first week in July—this set is of the turbine blower order. The purifiers are 10 feet by 8 feet by 5 feet deep, with dry lutes; a 40-horse power boiler, horizontal type, and a 10,000-gallon oil tank, are also in the equipment, and the plans call for the construction of a 100,000 cubic foot storage holder, although at the start one of 20,000, to act as a relief holder ultimately, will be put up. The plant is a modern one, and it has been built out of the proceeds of bonds sold right here in beautiful Chester county. Our officers are: President, Hon. Plummer Jeffries; Secretary and Treasurer, Jesse A. Johnson; Gen. Manager, Chas. F. Cattell.

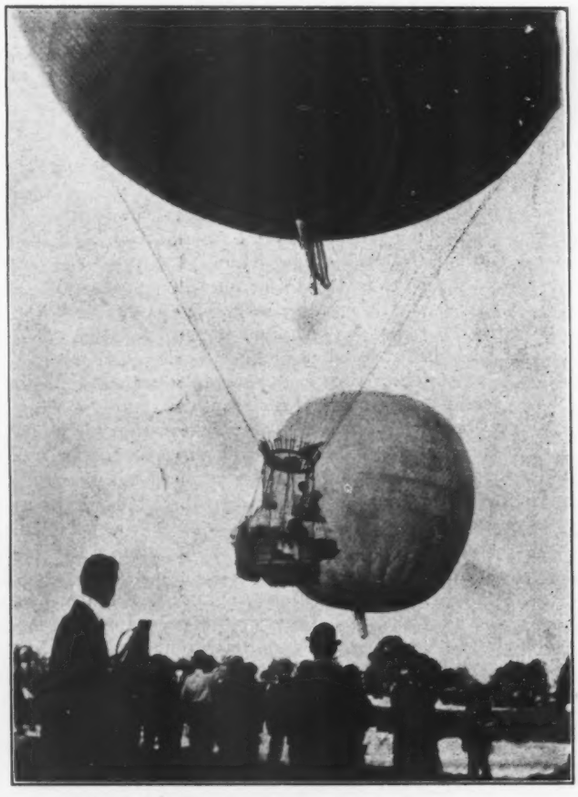
MR. WM. H. FRITCHMAN has been appointed Manager of the plant and business of the Brockport (N. Y.) Gas Light Company, the fortunes of which are dominated by Messrs. Bush and McBain, who have determined to go on with the good work in reasonable manner. As the Canal Commissioners have, in routing the new canal line, about determined to take a good slice out of the Company's property, the proprietors are arranging for the construction of a new retort house, capable of covering one bench of 6's and one of 4's, to be eked out by a 4-foot water gas set. It is also likely that a storage holder, up to 40,000 cubic feet, will be constructed. The extension to Holly will go over until 1910, as the Canal contractors will be very busy in this section all summer and fall. Besides, as our informant quite properly concludes: "We will have enough to do ourselves to be in readiness for our consumers by October 30."

MR. H. D. FRUEAUFF, the wideawake Vice-President and Secretary of the Pueblo (Col.) Gas and Fuel Company, is surely spreading the light respecting how the Puebloites may improve their kitchen service and accordingly be the recipients and absorbers of cooking done properly and accomplished at low cost to the bank account and with exceeding comfort on personal account. Last month he had attached to the bills a "sticker" describing Mrs. Hiller's ways and means of broiling a steak at any hour. Next month he will have another "swell way" of cooking something or another, printed on the sticker to the bill, and so on. Thus far the output at Pueblo shows an increase over the sendout for the first half of 1908 of not quite 18 per cent.—which is moving a trifle; don't you think?

The Aero Club's Balloon Races, Indianapolis, Ind.

[Prepared for the JOURNAL, by MR. CARL H. GRAF.]

The annual races of the Aero Club of America were held at Indianapolis, June 5, 1909. In preparing for these races it was the desire of the Indianapolis Gas Company to furnish the best gas possible for this purpose. With this in view we started in, several weeks in advance, on a series of experiments, to obtain this end. As we had no spare storage holder which could be filled up with low gravity gas in anticipation of the event, and could only furnish the gas as it was made, it was not an easy undertaking. The coal gas was furnished from a retort house having a capacity of 1,500,000 cubic feet per day, but as the benches are in poor condition, and as all the retorts will have to be renewed shortly, the normal capacity at this time is only about 1,200,000 cubic feet per day. The coal gas is taken through separate exhausters, purifiers and station meter, and is mixed with the water gas at the inlet of the storage holder. The first thing that was done was to cut in a 16-inch check-valve in the coal gas line, between the coal gas station meter and the inlet of the holder. This check-valve was weighted to the point where it would take 3 inches



of pressure to open same. This gave the assurance that, even if the check-valve leaked, under no conditions could gas come back from the water gas line or from the storage holder; and also allowed any surplus gas not needed for the balloons going directly into the storage holder, thus preventing any unusual back pressure. A 10-inch connection was made in the coal gas line between the station meter and the check-valve, which 10-inch connection was used as a suction line to the compressor, pumping the gas to the balloons. In this suction line is an anti-vibration tank, about 30 feet long and 6 feet in diameter, to prevent the vibration, due to the compressor, being transmitted to the drum of the station meter.

The balloon ascension took place at the Indianapolis Motor Speedway, which is located 4 miles from the gas works. A special line of 5½-inch casing was run for this purpose. This line was carefully laid and tested under a pressure of 50 pounds. The end of the line was arranged so that 10 balloons could be filled at the same time.

Realizing that it was desirable to fill the balloons in as short a time as possible, and that under the conditions mentioned only about 50,000 cubic feet of coal gas could be supplied, some experiments were made with the idea of getting a low gravity water gas. The first experiments consisted in running low fuel bed in our water gas generators and a surplus of steam, the object being to make as high a percentage of carbonic acid (CO_2) as possible. Experiments showed that about 8 per cent. of CO_2 is all that could be obtained on a continuous run, and even under these conditions it was difficult for the operators to properly manipulate the generators. After removing with lime the CO_2, from gas so produced, a gas of about .42 gravity was obtained. Operating in this manner being very uncertain, and the gravity of the gas not being as low as expected, these experiments were discontinued.

Some tests were then made by running the water gas sets in the ordinary way, with the exception that the heats in the carburettor and superheater were carried at the highest possible temperature that could be done without fusing the checkerwork. From 2 to 2½ gallons of oil were used per 1,000 cubic feet made. The high heats cracked up the oil and most of the heavy hydrocarbons were burned to lampblack. After removing the CO_2 a gravity of .35 was obtained, but at the end of 1 hour the washbox, condenser and scrubber were filled up with lampblack, so these experiments were discontinued. The plan finally adopted was to get the balloonists to start filling their balloons the afternoon before the day of the races. The heats in the retort house were raised, the weight of the charges reduced about 10 per cent., the time of charge increased from 5 hours to 6 hours, and a slight back pressure was carried in the retorts. The last box of the purifiers was filled with lime. One-sixth of the retorts were charged every hour regularly. For a short time after charging, the stoppers were removed from the standpipes and the gas escaped with the air. By this means we were able to take out about 10 per cent. of the heavy gravity gas that is produced when the retorts are first charged. More of this heavy gas would have been taken out, but the standpipes became very dry and filled up with lampblack.

The balloons started to fill about 3 P.M., June 4, and were practically all filled by 1 P.M., June 5. Specific gravity tests were made on the gas throughout, at intervals of 30 minutes or less, and in all 55 tests of this kind were made. Very little gas was taken between midnight of June 4, and 3 A.M. June 5, so no tests were made during this period. The specific gravity tests showed the following:

June 4, 2:45 P.M.	to	12 P.M.,	average specific gravity	.418
" 5, 3:00 A.M.	to	6 A.M.,	" " "	.419
" 5, 6:00 A.M.	to	1 P.M.,	" " "	.417
Average for total				.418

The highest gravity obtained at any time during this period was .449, and the lowest was .379.

The following balloons were filled:

Balloon.	Capacity, Cubic Feet.
New York	80,000
University City	80,000
St. Louis III	80,000
Indiana	80,000
Hoosier	80,000
Cleveland	80,000
Chicago	110,000
Indianapolis	40,000
Ohio	40,000

The first 6 balloons were entered in the national race. The last 3 were entered in a handicap race, as in the national race only balloons having a capacity of from 60,000 cubic feet to 80,000 cubic feet were allowed to enter. The distance race was won by the University City; this balloon having covered 382 miles in 26 hours and 35 minutes. The New York won the endurance race, covering 355½ miles, but having remained in the air 35 hours and 10 minutes. The Indiana remained in the air 48 hours and 30 minutes, but was disqualified on account of coming near enough to the ground to get a bucket of water, although it did not actually make a landing. The handicap race was won by the Indianapolis, having covered a distance of 225 miles in 19 hours. These figures are unofficial.

Field Operations in Natural Gas.

[A paper read by Mr. Wm. McNair Welch, for the Natural Gas Association of America.]

Under the subject of field operation one might confine himself to the limits of what are generally known as the field or district wherein the wells are located, or a more general meaning might be attached to the term field and the observation be applied to the entire scope of work carried on, embracing everything necessary to create and conduct the physical plant of a natural gas company.

Whatever the limits, or lack of limits, of the title assigned to this paper, perhaps I have not been particularly influenced thereby, but propose to call attention to a few points, taken almost at random from the general situation, which I believe it would be well to bring out, not for the purpose of expounding my own views, but for the better purpose of bringing the matters before you, so that a discussion upon them can be had which may lead to a correction of evils in some instances and an improvement in those things which are good in others. Neither have I confined myself solely to a discussion of existing conditions, but have taken the liberty of calling attention to advances or changes which may or may not be advisable.

The question of gas supply is of paramount importance to every gas company. The expectation of every stockholder for a return upon his investment, and the hope of every individual fortunate to have the gas brought to his door, for its continuance there, are based upon the supply. This is something we cannot see, neither can we measure it, in the same sense that we can measure a deposit of coal or iron ore, and it is something that, after we have approximated a measurement of it, we cannot be sure that we will get our full measure when we want to use it, for our neighbor may have wanted it first.

Natural gas is impartial. It recognizes no ownership until it arrives at the surface of the earth, and will be as readily coaxed into our neighbor's lines as into our own, provided he has the facilities in the way of wells and lines for drawing it. It is always restless to be moving and, once started, it will keep moving, either in our neighbor's direction or our own, until a more ready path is opened up to it. This tendency leads to a serious condition in the natural gas indnstry, especially in new and partially developed fields.

Until the market is provided there is usually a tremendous waste. Until this market is in sight the gas has only a nominal value, which is so low that the cost of preventing the waste is apparently too great to justify the expense of it, with the result that, by the time the market is provided, which in many instances in the past has been several years, a considerable percentage of the total available supply has vanished. Although the waste is still going on to an alarming extent it is gratifying to note that there is a growing tendency on the part of those who develop new fields to prevent it.

Returning to the question of supply for an existing or proposed system, which supply is constantly growing less, either through our own demand upon it or through our neighbor's demand upon it, if we are unfortunate enough to be afflicted with such, or through waste, it is imperative that we take steps to assure a sufficient supply, not only for the needs of the present and the immediate future, but also for the more distant future. This can only be done by looking ahead and providing a reserve of proven territory which can be drilled as the supply in the territory which is being used falls off or the demand increases beyond that supply. This reserve territory should only be drilled to sufficient extent to "prove" it capable of delivering certain quantities of gas in the future, and this can only be determined by our experience, which is in fact a comparison with other territory of similar conditions of pressure, depth and thickness of sand, etc.

It is exceedingly important to be able to approximate the length of time a given section of territory will continue to deliver a certain supply. To determine this with any degree of accuracy, careful and painstaking work should continually be done with this end in view. As a basis for this determination, careful, periodical observations should be made of the field pressures. Probably the most important is the rock pressure or that pressure in the sand from which the gas is taken. This is secured by closing in a well and observing the highest reading that the gauge on the well will register after the flow has been stopped for long enough time to allow the pressure to become stationary. The next most important pressures are those on the lines into which the wells discharge, and the rise in pressure per unit of time, usually a minute, after the flow has been stopped by shutting in the well.

These pressures serve as a relative indication of the amount of gas stored up, and of the rate of discharge from that storage through the wells into the lines. By careful observation of these pressures monthly, and comparing them from month-to month, by plotting them into "curves," it can be determined with reasonable accuracy how long a section can be depended upon for a certain supply. As this supply diminishes it then becomes necessary to extend the drilling operation to the reserve territory to the extent of maintaining the visible supply at the required volume.

The open flow capacities of all new wells are determined when the wells are drilled, and at one time it was the practice of gas companies to secure this open flow capacity at frequent periods later; but, as this custom necessitated the blowing off of the well into the air for several minutes, and frequently a much longer time, for the purpose of reducing the head or accumulated pressure before making the determination of the capacity, a large amount of gas was wasted and the practice was discontinued. In the past, and also at the present time, in several instances, the practice of carrying on these observations, for the purpose of determining the value of fields, has not been given the attention that it should, for no other line of work could have greater value than that of determining the extent of the resources which are the foundation upon which the entire structure of the business depends.

A matter bearing a close relationship to the supply is the one of wells, particularly the number of wells that it is advisable to drill upon an area of given size. The cost of a well varies from about $1,500 in shallow territory, of say 1,000 feet of depth, to $10,000 or more in the deeper formations of over three times that depth. It can readily be seen that the drilling of wells soon becomes a factor of decided importance in the problem of producing gas.

Different fields have various views as to the number of wells which should be drilled on a lease of given size. In the mid-Continent field it is generally assumed that one well for every 40 acres is about right; in other fields different customs are followed. But what are these customs based upon? Are they founded upon any definite knowledge that one well on every certain number of acres will deliver a maximum supply of gas to the surface lines at a minimum cost under any condition of pressure or sand? If these customs are correct it should be possible to demonstrate it by a careful analysis of the conditions, or it should be possible to demonstrate that they are not always correct for varying conditions which are found to exist and a plan arrived at for the correct determination of this matter.

The natural law governing the flow of gas through pipes, and expressed by the formula $Q = c\sqrt{\frac{P_1^2 - P_2^2}{L}}$, which formula is so well known that it need not be explained at this time, is such that, with given initial pressures on a section of pipe under consideration, the terminal pressures may be lowered beyond a certain point without proportionately increasing the value Q, or quantity of gas flowing. This condition affects the flow of gas from wells equally as it affects the flow through surface lines, and as a result there is a limit to the advantage of reducing the pressure at the mouth of a well, or the

pressure at the terminal of a line, which "limits" affect the entire situation, from the wells to the distributing points. There are several ways of determining the output or capacity of a well, such as by the use of the pitot tube for determining the open flow capacity, the minute pressure method for either open flow capacity or capacity against a line pressure, or by means of a meter on the line.

If some reliable experimental data could be secured which would establish the value of the minute pressure method, as compared to the method of finding the flow by means of the drop in pressure, which is used almost exclusively in line capacity determinations, it might be possible to place more dependence upon the minute pressure method, which is the most convenient of all methods of determining well capacities. This could be done by equipping a few wells with small pressure pipe of ¼ inch size, leading from the mouth of the well to the bottom. As there would be no flow through this pressure pipe, and as its size would be insignificant as an obstruction to the flow from the well, we would have the pressure at both the top and the bottom of a well, from which we could determine the flow in the same manner as we determine the flow through surface pipes and a comparison be made with the minute pressure method.

The manner of drilling wells, anchoring the fitting at the mouth so that the pressure of the well, when the valves are closed, will not lift them and either dislodge the packer, part the tubing, or break the connections at the top, and also the manner of connecting to field lines, are standard and admit of no considerable amount of variation. Different conditions of pressures, water in the wells, and the nature of earth drilled through, affect largely the equipment of a well; but there is very little latitude allowed the individual. These conditions have to be met, and there is usually a best way of meeting them.

The question of water in wells is one worthy of very careful consideration. We hear frequently that wells of enormous volume or capacity and high pressure are "drowned out," which means that in some mysterious manner water has shut off the flow of gas from the well. This has been known to happen overnight, when a well which had been producing large volumes of both gas and water had been shut in for a short time or when a well had been pulled on for too long a time. I have seen well reports where the wells have been classed as "dead" or "drowned out" at widely different pressures in the same field. Do the men who operate these wells know why they are dead, and do they know that when they abandon them they cannot be revived? We know that large volumes of water are delivered from water wells by means of the air lift system, in which compressed air is piped to the bottom of the well and liberated, with the result that the ascending column of compressed air diminishes the weight of the column of mixed water and air to such an extent that the pressure of the air starts the water flowing from the mouth of the well. This principle has been applied in recovering wells which have been drowned out, but the practice has not been adopted to the extent that the possible advantages to be derived from it would warrant.

After leaving the wells and field gathering lines, the next important part of the plant is the compressing station. This subject is practically an inexhaustible one, and will only be referred to here as it affects, or is affected by, the conditions of the main line, which will be taken up with a view of outlining in a very general way the past, present and possible future practice.

Although the changes in wells and field lines have been few in the last 10 or even 20 years, a constant change has been going on in compressor station and main line construction, with greater economy and increased efficiency the end in view. The leakages, which in the past were ever present in large lines, do not exist to-day with the modern, rubber-packed, coupling lines, and the enormous wastes in both fuel and leakage about the old-time pumping stations, where the gas was burned in the most crude fashion under uneconomical boilers and the work done by less economical engines, have ceased. At one of the modern gas engine gas compressing stations it would be difficult to detect even a small leak, and the power is developed in practically the most economical manner known.

In seeking for greater economy and efficiency in transportation a change has been brought about by a decided improvement in the material used in trunk line construction. This improvement is primarily due to the larger volumes of gas handled, and the longer distances between the points of supply and consumption. At the first stage in the development of the industry small lines were laid for short distances, without the use of pumps or compressors. The next step was to increase the distances and also the size of the line. When the distances were short and the pressures low, pumps of small power but large capacity were sometimes used in connection with large lines. The limit of the development in this direction was reached when a line 36 inches in diameter, 27 units long, of riveted boiler plate, was laid. To this was connected two rotary blowers with 24-inch inlet and outlet connections. Another installation that I know of consisted of two vertical, blowing engines, capable of producing a pressure on the outlet side of the machine of 8 pounds.

When these installations were made, some 15 or more years ago, there was an idea, more or less prevalent among gas men, that natural gas at high pressures would pack in a line and eventually burst it. This, of course, was soon found to be a fallacy, and there commenced a development which has continued until the present day, and the end of which is not yet in sight.

At the present time the longest line of 16-inch pipe or larger is about 250 miles, and the maximum pressure carried upon it is 350 pounds. Although this line was put into service about 6 years ago, it was only about a year ago that another line of 18 and 20-inch pipe, and proposing to carry the same pressure, was undertaken.

The reason why the large lines, built after the first high pressure system was put in, were not designed for pressures exceeding 300 pounds, is that there was not on the market a satisfactory coupling joint for the higher pressures. The couplings which were entirely satisfactory at 300 pounds were not adapted to the higher pressures. This was on account of the design of the couplings and the material used in their construction. The center ring, which had to resist a bursting strain due to the pressure of the gas in the line, was made of cast iron, and it was found impracticable to make a cast iron center ring sufficiently heavy for pressures above 300 pounds. When, however, about 4 years ago a coupling with a steel center ring was brought out, the first step was taken towards overcoming the difficulties which had up to that time limited the pressure carried. The steel center ring has now been perfected to such an extent that a rubber packed coupling joint will hold gas under any pressure that the pipe will stand, and there remains no reason, so far as this feature is concerned, why large lines should not be built to operate under 400 or 450 pounds, or even for possibly higher pressures. Other problems will have to be met in carrying these pressures, and they would have to be worked out as they were met; but there does not seem any insurmountable obstacles in the way of reaching these figures in the near future.

Our experience with even higher pressures on smaller lines, and with 300 pounds on large lines, up to 18 and 20 inches, enables us to know in what respect changes in our present methods and material would have to be made. One necessary change would be to abandon the use of cast iron in making large fittings, such as ties, wyes, valves, etc. The proper material to be substituted could readily be determined and would probably be either cast steel or riveted wrought steel, the two requirements being that they should have the strength to resist the bursting strain and should not leak.

The objection to cast iron fittings as now made is that the excessive thickness to which they would have to be made would introduce an element of danger from shrinkage strains which do not always make themselves evident under the test pressure to which the fittings are subjected; but often at a later time, when in service, these strains cause the metal to crack and sometimes fail entirely, with consequent serious damage and loss of service of the line in which they had been used until others are put in their place.

In addition to this feature, lines would have to be laid a little deeper and braced a little more securely; but all such matters could be readily taken care of.

The advantages arising from carrying higher pressures I believe will be found numerous. When a long system is being considered the question of compressor stations is one that must be as carefully weighed as that of the line itself, for there can be no long natural gas system without compressor stations. To enable us to gather an idea of these advantages, I propose to outline two cases of long distance transmission, one under the present range of pressures, with 300 as the maximum, and the second under an assumed condition of pressures with a maximum of 450 pounds. There are several ways of approaching this problem. In both cases, however, we must undertake to deliver the same amount of gas to the distributing system at the same pressure, and the gas must be received from the field at the same pressure. To do this under the different conditions af pressures we must either have different sizes of lines with the same number of compressing stations, or, if we have lines of the same size, the number of compressing stations must change. I have approached the problem in the following manner:

The quantities which I assumed are as follows: Both cases approximately 300 miles of 18-inch line, delivering 60,000,000 feet, in addition to the fuel required, taking it from the field at 100 pounds and putting it into the distribution system at 60 pounds. It was also assumed that gas engines were the means of power, for it was not thought desirable to figure on the cost of a separate line to furnish fuel to operate steam engine stations. The fuel for the gas engines was based upon a consumption of 12 feet per horse power hour.

System A.—Maximum pressure, 300 pounds, corresponding to the discharge pressure from the stations and the initial sections of lines; terminal pressures on the sections of lines except the last 100 pounds. This terminal pressure on the lines corresponds to the intake pressure of the relay stations.

System B.—Maximum pressure, 450 pounds; terminal pressures on lines, 200 pounds, except last, which pressure in both systems was assumed to be 60. The intake pressure on that station at the field in both cases was assumed to be 100 pounds.

The following results were arrived at:

System A.—Six sections of line and six compressor stations, with an aggregate horse power of 22,000, requiring 6,200,000 feet daily; the sections of line ranging from 60 to 45 miles and averaging 50 miles in length. The sections of line were shorter towards the field end of the line, on account of having to transport the gas used for fuel and also on account of the lower pressure at the distribution system.

System B.—Three sections of line and three compressor stations, with an aggregate horse power of 9,800, requiring 2,800,000 feet daily; the sections of line ranging from 130 miles to about 80 miles, for the same reasons as given for System A.

System B, carrying pressures of 450 pounds, would require a pipe of about $\frac{1}{8}$ inch greater thickness than would be necessary for System A, carrying 300 pounds. The increased cost of the heavier pipe would almost, but probably not quite, balance the increased first cost of the compressor stations, but the great saving is made both in the fuel and labor of operating the smaller and fewer stations and in the lower maintenance and depreciation costs of System B.

If the problem had been approached in another way, that is, by changing the sizes of the lines and keeping the number of stations the same, there would have been a difference in first cost in favor of System B, and consequent lower fixed charges, but the operating, depreciation and maintenance charges would have been about the same. It is probable there would have been little difference in the net result, which seems to be largely in favor of the higher pressures.

I offer these suggestions in regard to high pressure transportation of natural gas as being in line with the trend of the development and strongly recommend that investigations along these lines be carefully and exhaustively made by inquirers contemplating the design of long distance transmission systems.

Gas Arc Installation and Maintenance.

[Read by Mr. Arthur Hewitt, Assistant General Manager, Consumers Gas Company, Limited, Toronto, before the Canadian Gas Association.]

I hesitated to comply with the request of the Secretary of the Canadian Gas Association to prepare a paper on the subject of "Gas Arc Installation and Maintenance," feeling that other members of the Association were better qualified for the task. However, as the best men are not always available, I concluded that the Secretary realized his responsibility and fully understood the risk he was running in making the request.

Until about a year ago Toronto was a "mark" for the introduction of all and every kind of lighting appliances, good, bad and indifferent. Notwithstanding the low price of gas, 75 cents net per 1,000 feet, no additional charge for meters, and other advantages enjoyed, the consumers of gas in Toronto were not getting as good a lighting service as was possible, because of the inferior and wasteful burners in more or less general use. There were almost as many *types* of lamps as there were *lamps*, the principal variation being in the degree of inferiority. There was the added fact that little if any attention was being given by consumers to keep their lamps in a serviceable condition.

The first step taken by the Consumers Gas Company towards improving this state of affairs was to employ a number of men to clean all arc lamps once a month and put them in as good condition as the circumstances would permit. No charge was made for this work, but necessary supplies were furnished by the Company at a trifle over cost price. The service proved very acceptable to many of the consumers, but *as they owned the lamps and had to pay for the supplies*, it was in many instances difficult for the men to obtain permission to clean the lamps and to replace broken mantles and fittings. Conditions were somewhat improved; but still the problem was not solved.

The second step taken was to select as good an arc lamp as could be obtained, offer it for sale at a small margin over cost, and undertake its maintenance with as little expense to the consumer as possible. A measure of success followed this policy, *but still the consumer owned the lamps and controlled the maintenance.* Hence, the principal difficulty remained. It was not until the month of December last that the system which I shall outline was adopted, and the only excuse which I can offer for taking up the time of the Association with this paper is, that the plan has succeeded beyond our highest expectation. When you learn that from the 1st of January to the 31st of May, a period of five months, with only three solicitors or representatives employed, yearly contracts were secured for over 1,900 Humphrey gas arc lamps, and that the service is giving absolute satisfaction to the consumers, you will readily understand that the officers of the Consumers Gas Company are extremely gratified.

With these preliminary observations, I shall endeavor to interest you with a reference to the details of the organization of our arc lamp department.

There was in the Toronto Gas Company's premises a large basement which had not been used for a very long time, excepting for unimportant storage purposes. This basement was cleaned up and put into condition fit for occupation. The space was divided as follows: Two storerooms for lamps and supplies, a lamp-cleaning room provided with water tanks and hot and cold water service for the washing of the globes, shelving for the lamp globes, a shop for gasfitters, and a suitable office for the foreman and his clerk. A room on an upper floor of the same building has been appropriated for such office work as relates directly to the department. Three experienced arc light solicitors were engaged, each solicitor being assigned specific territory. These solicitors have the essential qualification of being gasfitters as well as salesmen. Their duties consist in explaining the advantages of the gas arc lamp from a lighting standpoint, and its comparatively low cost, and in securing annual contracts per lamp at 50 cents per month. Having secured a contract they advise as to the most advantageous locations for lamps for satisfactory results, make measurements for necessary piping and specify all that is required for the proper installations of lamps.

Wherever piping has to be done, estimates are made to the consumer at the time the contract is secured, so that there can be no cause for misunderstanding after the work has been done. The experienced solicitor will not recommend arc lamps in places for which they would be unsuitable, and will even refuse orders if in his judgment some other class of appliance would give more satisfactory results. An inexperienced representative might be able to get business, but his ability to determine what ought to be done under varying conditions would result in the wholesale discarding of improperly installed lamps.

A meeting of the solicitors, the shop foreman and a head office representative takes place every morning, and lasts about 30 minutes. At this meeting the contracts secured during the preceding day are handed in, together with the shop order forms on which the solicitors are required to give a complete specification of the work to be done in connection with the carrying out of each order. A not unimportant feature of this morning meeting is the discussisn of points of interest in connection with the canvass, asking and answering questions of policy, the consideration of various conditions and difficulties which arise from time-to-time, and the suggestions made as to how the Company's service can be improved in any direction.

The success of the arc lamp business depends upon the service which is given, and that service begins with the solicitor who secures the business, continues with the gasfitters who install the lamps, the quality and pressure of the gas supplied, and perhaps above all the efficiency of the men engaged in maintaining the lamps, for it is indispensible that lamps be kept in perfect condition. Glassware must be regualrly cleaned, mantles examined and replaced where necessary, gas checks or nozzles and screens must be kept free from dust, and adjustments made so as to give the highest efficiency.

In order that absolutely reliable data could be obtained as to the cost of the arc lamp service, the Department is being conducted as an

entirely separate unit. It is credited with all its earnings and charged with all expenses, excepting the salaries paid to the solicitors, the practice of American gas companies being to consider the salaries of their representatives a general expense.

When the proposition to install arc lamps on a maintenance plan was being considered by the Company, the estimates submitted were based upon the assumption that 2,000 lamps would be put into service in the first year. This number has been very nearly reached in the first 5 months.

For the purpose of illustrating the points of difference between selling the lamps outright and installing them under yearly contracts, with the monthly charge for maintenance, we will assume that in one case 2,000 lamps have been sold to consumers and their maintenance undertaken by the Company, at a charge to the consumer of 25 cents per lamp, per month; and in the other case that 2,000 lamps have been installed free of charge to the consumer, and the contracts taken for their maintenance at 50 cents per lamp, per month; the Company in the latter case retaining the ownership of the lamps. These rates all relate to indoor and not to outdoor ones, for which higher charges are made.

HYPOTHESIS.

Each indoor lamp costs the Company $9 installed in the consumer's premises. For each lamp sold by the Company, the consumer pays $12. Each lamp in service will consume (average) 2,000 cubic feet of gas per month—24,000 cubic feet per annum.

PLAN 1.—*Selling Lamps to Consumers.*

The Company sells 2,000 lamps at $12....	$24,000
The Company buys 2,000 lamps at $9....	18,000
Company's profit on lamps sold.....	$6,000

Lamps which are sold outright are maintained by the Company at 25 cents per month (if the consumer consents), which is not more than sufficient to cover the cost.

PLAN 2.—*Lamps Owned by the Gas Company.*

A Gas Company buys 2,000 lamps at $9.....		$18,000
First Year:		
Receipts from 2,000 lamps at 50 cents per lamp per month.		$12,000
Interest on $18,000 at 5 per cent.....	$900	
Maintenance of 2,000 lamps at 25 cents per month...	6,000	
		6,900
Surplus.....		5,100
Reducing capital investment to.....		12,900
Second Year:		
Receipts from 2,000 lamps at 50 cents per lamp per month.		$12,000
Interest on $12,900 at 5 per cent.....	$645	
Maintenance of 2,000 lamps at 25 cents per month...	6,000	
		6,645
Surplus.....		5,355
Reducing capital investment to.....		7,545
Third Year:		
Receipts from 2,000 lamps at 50 cents per lamp per month.		$12,000.00
Interest on $7,545 at 5 per cent.....	$377.25	
Maintenance of 2,000 lamps at 25 cents per month	6,000.00	
		6,377.25
Surplus.....		5,622.75
Reducing capital investment to.....		1,922.25

And the 2,000 lamps are still owned by the Company.

Now, let us consider both propositions from a gas selling standpoint. Two thousand lamps, each consuming 24,000 feet of gas per annum, represent a total consumption of 48,000,000 cubic feet. Each member of this Association can make his own estimate of profit, but we shall suppose it to be only 15 cents per 1,000 feet and we have a total profit of $7,000 per annum, the people have received the best possible service at a low cost, the original investment in lamps has been wiped out in a little more than 3 years, the undertaking has enabled the Company to keep in close touch with its customers, and it had developed an organization which is capable of useful service in many ways. So much for the advantages of the rental system.

It has been claimed by advocates of the system of selling lamps to consumers that where a consumer himself has an investment in gas arc lamps he is less likely to discard them for other systems of lighting than if the appliances are the property of the Company. This is the one strong argument for the plan, and as an abstract proposition it looks all right. However, in Toronto comparatively few consumers could be induced to invest $12 in an arc lamp, while in 5 months contracts have been secured for the installation of nearly 2,000 lamps on a maintenance basis, and contracts are being more readily secured at the present time than when the campaign was first started. What appeals to most of the consumers is the fact that the lamp is supplied to them free. They are quite willing to pay 50 cents per month for efficient service.

To determine which plan is the best, we must consider the results obtained from each, and I am convinced that in most cities, for each lamp sold outright, four lamps can be installed on the maintenance basis. Therefore, the system of installing lamps on a maintenance basis will sell four times as much gas as the plan of selling lamps outright to consumers. My references thus far have been to inside lamps only, but there is another fruitful field—outside lighting service. If the inside lamp is a good proposition from the consumer's standpoint, the outdoor gas arc cannot fail to commend itself. What system of outside lighting as effective as the gas arc can be secured at anything like equal cost—2 cents per hour—I do not know of any.

On the Company's part, however, it must be realized that the cost of maintaining outdoor lamps is considerably greater than for inside lamps. The lamps themselves cost more, a larger number of mantles are destroyed, and it takes a longer time to clean and regulate the lamps. In Toronto the maintenance charge for outdoor lamps has been fixed at 75 cents per lamp per month, and the margin over actual cost is approximately the same as in the case of inside lamps at 50 cents per month. In 5 months the Company in Toronto has installed 310 Humphrey outdoor lamps, and the prospects for further business is very good. I am not aware of a single consumer being dissatisfied either with the light or its cost. Great care is necessary in hanging outside lamps. They must have supply pipes of ample capacity and be provided with a simple form of drip. (Here I might remark that we have not had a frozen arc lamp in Toronto since the service was inaugurated in January last, due largely to the kind of drip used in our installations.) The lamps must be set so as to be exactly upright; otherwise, they will be an eyesore. The height from the ground to the bottom of the lamp should be from 7 feet 4 inches to 7 feet 6 inches, and the distance from a window from 12 to 20 inches, according to the purpose for which the lamp is required. If the object is to throw light into a window where goods are displayed, the lamps should be reasonably close to the window, but not sufficiently close for the heat given off to cause damage to plate glass. If required to attract the attention of pedestrians, the lamps will be best placed at about 18 inches from the window. For lighting a window from the outside exclusively, parabolic reflectors can be used to advantage; but as a general rule these fittings should not be recommended.

The question as to whether clear globes are better than opal ones depends upon individual judgment. Where the lamps are efficiently maintained, a clear globe will show the lamp to the best advantage from a lighting standpoint. In fact, the principal objection which I have heard regarding the clear globe is that there is too much light. The alabaster globe softens the light considerably, and for some purposes is an absolute necessity. In Toronto about 75 per cent. of the lamps have been installed with clear globes, and in the city of Chicago there are not many other than clear globes in use. On outside lamps, especially, I consider clear globes the best.

If there is any phase of the subject which has not been dealt with as fully as the members of the Association would desire, I shall be pleased to give whatever further information I may be possessed of on request.

The one thing which I would emphasize above everthing else is the importance of gas companies directing their best efforts toward improving the lighting service given to customers. The companies enjoy very extensive powers and privileges, and the public have a right to expect efficient and reliable service—and in this the public should not be disappointed.

Candle Power of Gas in Canada.

[Read by MR. JOHN KEILLOR, Superintendent Hamilton (Ont.) Gas Light Company, before the Canadian Gas Association.]

Do gas companies in Canada make and sell the quality of gas best suited for the present-day requirements of the gas consuming public? This is a question which, as an Association and individually, we ought to consider and pass a verdict upon. A great deal of attention has already been concentrated upon it by the gas industry in Europe and the United States, and in Canada, too, it has doubtless been in the minds of many gas engineers for years, though no concerted action has thus far been taken by any representative body in the matter of determining whether or not we are actually making and supplying

the candle power or calorific power of gas best suited for the all-round requirements of our customers.

When I was requested to write a short paper for this meeting I could think of no other subject that was likely to command the interest of the members more than a brief consideration of the Government statutes governing the testing and quality of the staple product it is our business to make and sell the year round. This contribution, however, is only introductory, so far as its reference to gas making in Canada is concerned, and it is not to be considered as dealing exhaustively with any one phase of the subject—commercial or practical. I shall touch only on a few matters bearing on this subject, and refer you for details to the recorded experiences and practices of those gas engineers who have already threshed out the question and adopted new standards to govern the candle power of gas supplied to their consumers.

The following are three good reasons why we should consider this question: (1) That there has been no change in the Dominion Government statutes regulating the testing of gas and the candle power that is to be supplied for 23 years. (2) That during those 23 years the methods of using gas have so totally changed that there is no longer any need for supplying to consumers the quality of gas prescribed by the Gas Inspection Act of 1886. (3) That in other countries regulations respecting the testing of gas have been revised to suit the new conditions, and the candle power of the gas reduced.

I think, therefore, the time of the Association will be well spent in considering briefly that part of the 1886 Act which governs our operations and ascertain, if we would not be justified in making a recommendation to the chief electrical and gas engineer of the government, recommending that the departmental regulations be amended so as to permit of gas companies—if they wanted to—making a lower quality gas, a gas suitable for the all round requirements of our customers.

From the viewpoint of the economical gas maker, who desires to give his customers a plentiful supply of cheap gas, and make a good profit for his company at the same time, I believe there is no other subject more worthy of his close study, especially as he owes it to his employers and consumers alike, to see that the gas he sells is the cheapest and most adapted for the purposes for which it is to be used.

Everybody knows that gas companies throughout Canada are manufacturing gas, varying from 16 to about 26-candle power, unless as provided for in Clause 28 of the "Gas Inspection Act, 1886," which reads:

"That every undertaker (gas company) in any city, town or place where there is an inspector of gas shall be held to have undertaken—that the quality of gas to be supplied to the purchaser shall be such that the light produced by a standard burner consuming 5 cubic feet of gas per hour shall be equal in intensity to that produced by 16 sperm candles, etc. * * * Such quality to be called 'standard quality,' unless such undertaker has expressly undertaken to furnish gas of some other quality as to its illuminating properties which shall be called the 'prescribed quality,' etc."

I do not know that there are many companies empowered by private bill or otherwise to "furnish gas of some other quality as to its illuminating properties," but if so, they are very few, and in any case this would not affect the question before us. Speaking generally, gas companies in Canada are supplying gas from 16 to 20 candles; more often, around 17 candles. Gas makers, in order to avoid the penalty, are anxious to maintain the candle power rather higher than the 16-candle standard prescribed by the Gas Inspection Act, 1886. If we take, therefore, as the average 17 candles as tested by the "standard burner," we have a fair representation of the quality of manufactured gas being made and supplied throughout the Dominion at the present time.

Now, the questions I put to you are: Do we really need in the year 1909 to make and send out this 17, or even 16-candle gas? Does the consumer demand it? Is it the best and cheapest gas from his point of view? Are we making it because it is the best all-round gas for the needs of consumers generally, or have we, by long and patient practice, become so expert at making and blending this quality that we dislike the idea of a change? Probably it would be more correct to say that we are making it because the "Gas Inspection Act, 1886," requires that this quality be made. Anyhow, if we are making it because it is the best all-round gas for the needs of our customers, then there would be no need for changing the statutes and advocating a reduction in illuminating power of the gas sent out from the gas works. But, on the other hand, if we were agreed that it was in the best interests of the consumers and gas companies alike to make and distribute, say, a lower candle power gas than 16 candles, then it would be apparent that the regulations as they exist were wrong and required to be amended to suit the new and more economical methods and conditions of using the gas.

Similarly it may be queried: "Is the grade of gas which was best suited for the requirements of gas consumers in 1886 the best suited and most economical for consumers in 1909?" Personally, I say it is not; then, if it is not, and you agree with me, why are we making it? It is well known that the great bulk of the gas we are making to-day is being used for totally different purposes than the gas which was made and used in the year 1886, when the legislation governing the quality of gas was enacted. In 1886 practically all the gas made by gas companies was sold for illuminating purposes by the Argand, flat flame and other luminous burners. The proportion used for cooking and heating in those days would not amount to 5 per cent., whilst there was none at all used for power purposes and lighting by the incandescent burner. To-day these conditions are radically changed. We find, according to reliable authorities, that instead of about 5 per cent, or less, being used for cooking, heating and lighting by incandescent burners, from 70 to 80 per cent. is used for these combined purposes, and not more than about 20 per cent. used for lighting by the Argand and flat flame luminous burners - the Argand burner, by the way, having dropped out of practical use altogether.

The following indicates approximately the quantities of gas used for the various purposes in 1886 and 1909:

	In 1886, Approximately. Pr. Ct	In 1909, Approximately. Pr. Ct.
Gas used for light by luminous flame burners....	95	20
Gas used for cooking, heating and power purposes	5	80
Gas used for lighting by incandescent burners....		
	100	100

Now, nobody will dispute the fact that 95 per cent. or more of the gas sold in 1886 was used for lighting by the luminous flame burners. This necessitated making high candle power gas, so that with the Argand or "Standard" burner, a light equal to at least 16 candles could be obtained, the gas being used at the prescribed rate of 5 cubic feet per hour; and so it was that the Government provided that gas companies would have to maintain a 16-candle standard. That was a wise measure at the time, and gas companies had no objections to make, the regulations being intended to protect the consumers who used those luminous burners against the possibility of getting poor light. But remember that those Argand and flat flame burners were the best and most efficient on the market at the time, the Argand being adopted by the Government as the "Standard" burner for testing the gas. That was in 1886, 23 years ago. Argand and flat flame burners were in general use then. You could find them in stores, houses, public buildings, etc. They represented the best and most efficient burners that could be made in those days. Now, look at the changed conditions in 1909. Only about 20 per cent., or less, of the gas made is now being used by luminous flame burners against 95 per cent, or more, 23 years ago. To-day approximately 80 per cent. of the gas made is being used for cooking, heating and incandescent lighting, against less than 5 per cent. in 1886. You will see, therefore, that the bulk of the gas is no longer used for lighting by Argand and flat flame burners. Very few gas consumers, if any, now use the Argand burner, and the flat flame very little. No gas company, or appliance man, sells Argand burners today, and I doubt if anybody uses them now but the Government—and the Government uses them for testing the grade of gas, which I am strongly of opinion the public no longer need. I have said that since 1886 these luminous flame burners have almost totally disappeared. They have been superseded in the interval by modern, upright and inverted incandescent burners in nearly all places where good illumination is required.

Nowadays, a light of 60 candles can be easily obtained from a good type of incandescent burner consuming 3 cubic feet of gas per hour.

Compare this with the candle power obtained from the "Standard" Argand burner referred to in the Act, 1886.

Type of Burner,	Gas Consumed per Hour Cubic Feet,	Candle Power,	Candles per Ft. Gas Consumed.
Standard Argand burner.....	5	16	3.2
Modern incandescent burner.....	3	60	20.0

The modern incandescent burner yields about 7 times more light per cubic foot of gas consumed than the Argand, and from a lower quality of gas than the Government standard quality.

Taking into consideration these changed conditions of using gas and our own everyday experience, it is evident that what we are called upon to supply now is not a "lighting" but a fuel gas. For, in addition to gas used for cooking, heating and power, is not the gas required for use with the mantle burner in the same category? We do not push the sale of a single appliance nowadays that necessitates the making of high candle power gas. The gas range, the water heater, the industrial furnace, the gas arc, etc., can all be well served with a lower grade gas than we are now making. And consumers who use these appliances represent our best and most profitable customers. Let us be sure, then, that we are making the grade of gas best suited for the majority of our customers rather than the minority. I am afraid most of us to-day are supplying gas that suits best the minority luminous flame customer. Many of us know it and admit it, but we shelter under the gas inspection act, which compels us to make this quality.

I am one of those who would like to see the candle power of gas in Canada down to at most 14 candles, and to 13 or even 12 candles, if the calorific value were not depreciated too much thereby. Of what use is it to keep up the quality by 2 or 3 candles at considerable cost, when the consumer can now get a vastly superior light by the incandescent burner from a common coal gas of from 12 to 14 candles? Moreover, this quality is good enough for all other purposes for which the gas is used, representing at least 80 per cent. of our output.

I am sorry I cannot lay before you at this time figures relative to the calorific value of Canadian gas of 16 candles and under, but in the event of this Association deciding to appeal to the chief electrical and gas engineer for amendment of the departmental regulations, tests of calorific value of say 12, 13, 14, 15 and 16-candle gas should be made before recommending a reduction to any particular candle power. There is a limit to which we can go without sacrificing too much the heating value of the gas and this would require to be determined.

There is another good reason why we should have a reduction in candle power. I understand that in 1890 an Amendment to the 1886 Act was passed providing that "the expression 'GAS' be held to include natural as well as manufactured gas." Now, it is well known that natural gas, which is practically non-luminous in flat flame burners, is allowed to be used for general lighting purposes, and the Government do not enforce natural gas companies to enrich their gas to the Government standard. It is good enough for all practical purposes as it issues from the earth, any enrichment would be a waste of money. I object strongly, however, to artificial gas companies being discriminated against. We should either be allowed to send out a lower quality gas, or the natural gas companies should be compelled to enrich theirs to Government Standard.

Construction and Operation of a Gas Works in a Town of 5,000 People or Under.

[Prepared for the Fifth Annual Meeting of the Iowa District Gas Association, by MR. THOMAS CRAWFORD, Clinton, Ia.]

On account of the large number of small towns in Iowa which are rebuilding existing works that have become inadequate to serve the population, or where improperly constructed, and on account of the large number of new plants which are being installed, the writer was asked to give his experiences in the construction and operation of the plant at Maquoketa, Ia., recently completed.

The town has about 4,000 inhabitants, is the county seat of Jackson county, Ia., and is situated on branch lines of the C. M. & St. P. and C. & N. W. Railroads. An acetylene plant had been installed in this town, and at the time the writer took hold thereof it had 38 consumers and was sending out in the neighborhood of 1,200 feet of acetylene gas daily at $15 per 1,000 feet. Believing that a modern and up-to-date works would be a paying proposition in this town, we decided to rebuild it along the lines of modern water gas practice, eventually expecting, if the consumption warrants, to install a coal gas plant in connection with the property. However, the last idea has been practically abandoned. We decided to put in a water gas plant for the following reasons:

First, we did not have to operate continuously; second, at the present price of coke and oil, water gas can be made as cheaply as coal gas; third, our sendout would be so light for a long time during the development of the property that the cost of manufacturing of coal gas would be prohibitive.

We found, after investigation, that the building in which the acetylene apparatus was situated could be very handily arranged for a water gas plant by adding a purifier room on one side and a coke storage and boiler room on the other. We decided to install in this town, after due consideration of the various modern systems o distribution, a low pressure system. Having had considerable experience in distribution by high pressure, we hesitated a long time as to the proper method of distribution, looking at it from many standpoints. First, the initial cost; second, the service to be rendered; third, expense of operation. Taking all these matters and others into consideration, we decided to install a low pressure system. We looked over some of the plants operating under what is known as the Tenny process and system of distribution, but decided this town was too large in which to install that apparatus, believing, however, it has its place in smaller towns.

The first thing we did, on starting operations, was to rent a suitable office building on one of the main streets of the town, install modern office furniture, redecorate and equip the office in modern style, placing our fitters' shop in the basement. We installed a full line of fixtures, gas ranges and other appliances in the office, an electric sign and other modern methods of drawing attention to our product were installed in and about the office, even before construction work commenced, and a liberal amount of newspaper space was contracted for and used from the onset.

The apparatus at the plant consists of a 4-foot 6-inch water gas set, complete, with carburetter, superheater, scrubber and washbox, arranged conveniently, furnished by the Gas Machinery Company.

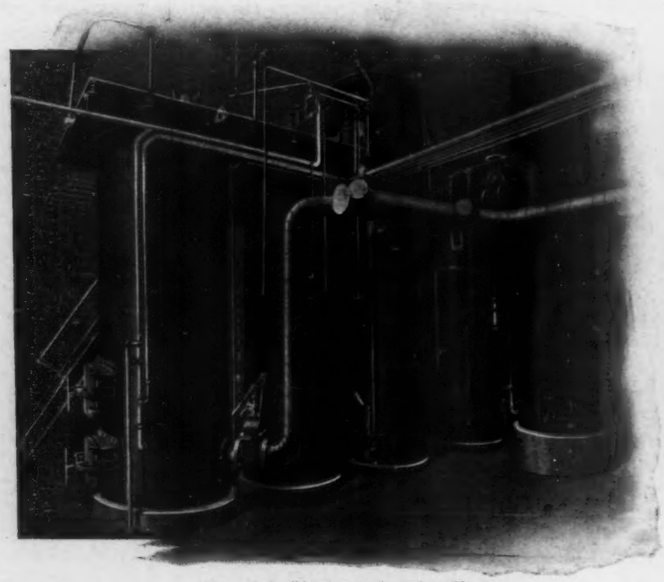
Maquoketa Plant, Front View.

The purifiers consist of two 10-foot circular boxes, 5 feet deep, with centerseal, allowing the gas to be reversed in 9 different directions through the boxes and into the holder. City water is used and a water connection is made with the holder tank for breakdown service.

The holder is of steel tank type, furnished by the Stacey Manufacturing Company, of 40,000 feet capacity. The holder throws 4 inches water pressure. Two vertical boilers, of the submerged-tube type, are installed, feed water being arranged for both pump and injector. The oil is fed into the apparatus by means of an automatic pressure pump, and an elevated tank is installed for gravity feed oil service.

A Sturtevant blower, counter-shaft, and suitable high-speed engine are also installed. A steam hoist is arranged for charging the gas generator and the entire gas making control is on the ground floor, the operator only going to the charging floor to drop the coke from the hoisting bucket into the generator.

The inlet and outlet to the holder are connected with a by-pass and valves, so that the gas can be made into or sent out from either the inlet or outlet. All valves are outside screw valves. There are also placed here by-pass and valves for future station meter. We did not install a station meter at once because we did not think the sendout, for a year at least, would warrant the expense of installing one. We expect, when our sendout reaches 30,000 feet per day, to install a station meter. We do not believe any plant should operate, or can be operated, economically without a station meter, but we did not feel justified in going to the expense when starting our plant. We have made all preparations to install one, however. The connections



Maquoketa Plant, Interior View, No. 1.

Maquoketa Plant, Interior View, No. 2.

are all 8-inch cast iron, throughout the works and to the holder, and to a point where our center of distribution commences.

A railroad side track is built to our works, across our own land, so that our material for construction work and our future manufacturing material are handled directly at our works.

We anticipate that our sendout will reach 60,000 feet daily in this town, and that we will install at least 800 meters. Our piping was designed accordingly. We have 120 feet of 8-inch pipe; 4,400 feet of 6-inch pipe; 4,200 feet of 4-inch pipe; 7,500 feet of 3-inch pipe and 45,000 feet of 2-inch pipe, covering practically every foot of available gas consuming space in the town, at present; in all, about 15 miles of main, 29 drips and 35 valves, including 3 miles of main used by the old acetylene plant.

Most of these drips are on the ends of services in the business part of town, where it is impossible to lay a service without putting them in. All service drips and drips of any kind were avoided as much as possible. There are only 9 main drips.

In laying the mains and services we observed strictly modern practice, using Dresser insulated joints and couplings, double connection at the service tap into the main, and conforming the main and service laying as near to the practice suggested by the Institute and various Gas Associations as possible. We used genuine, wrought iron pipe entirely for services and mains, no service pipe smaller than 1 inch is installed, and 1 inch used only on the short side of the street. Any run across the street was made with 1¼-inch pipe. We used ¾ inch lead meter connections.

The plant was purchased from the old company the latter part of August, 1908. The construction work, consisting of mains, 200 services and the gas making apparatus, including the holder, were completed and gas turned on November 30, 1908.

We were extremely fortunate in the construction of this works in being able to purchase material at a low point in the market, and to find the manufacturers of apparatus able to furnish and install the apparatus at once, it being a dull season with them. We employed local help as much as possible, which created considerable sentiment in our favor. The people welcomed the installation of the works from the onset, and no trouble was experienced with the city authorities, or anyone else, in the construction of the plant; in fact, they all co-operated with us in order to make the business a success from the start. We are selling gas at $1.25 per 1,000 feet, net, offering discounts to users in amounts over 5,000 and 10,000 feet. We sold appliances, fixtures and any other gas consuming appliance on easy terms, and by January 1, 1909, had over 225 consumers connected. We pushed the Humphrey arc lamp for store lighting, also the Welsbach reflex and harp fixtures. We made 19-candle power gas from the start and have given excellent service ever since. We pushed the prepayment meter. Eight out of every 10 of our consumers put this type of meter in, and it has proven very popular with all of them. We ran a house piping proposition, $2 a room, piped complete, ready to light, including fixture and burners. We furnished with each gas range installed one light free of charge, so that every place we set a range our light was introduced. The people having had no previous experience with the use of gas had to be instructed entirely as to its uses, and we took special pains to show every consumer how to use gas to the best advantage, spending an endless amount of time in satisfying some very peculiar people, who have been our best boosters.

We have as competition a water power electric light plant, with indifferent service, a great many of the merchants along the streets being stockholders in the electric light company, which has not been a financial success, and they were naturally hard to convince that the gas was the proper, safe and economical illuminant. The advent of the tungsten lamp in the electric business at this time also proved a competitor, but we have successfully met this competition with the "reflexolier" and the "inverted arc lamps," although the electric company furnished tungstens free.

We are using Solvay coke and 34° gravity gas oil, and are having excellent results from our gas making apparatus, also from our vertical submerged tube boilers. In fact, we are daily using but 17 pounds of slack coal per 1,000 cubic feet of gas in the holder, which we think is extremely low for fuel consumption in a small works. We are using 4 gallons of oil and 48 pounds of Solvay coke per 1,000 cubic feet of gas, and are succeeding in making a good quality of gas with the above material. As soon as we had our plant in operation we changed our electric sign to gas and find that it lights up exceedingly well at night with four 4-foot Bray burners. Our sign hangs across the 12-foot sidewalk, and reads: "For Fuel—Gas—For Light," being of the bull's-eye transparent pattern. We also installed two Welsbach street lighting lamp posts about town, and expect to make a bid for the street lighting next fall. The people are much pleased with the results shown from the street lamps.

We have complete and accurate records of all services, mains, meters, etc., having as complete a record as we have at our larger plant. Our system of bookkeeping is on the lines suggested by the American Gas Light Association some years ago, but simplified considerably. Loose-leaf systems of bookkeeping are used entirely. We expect to operate this plant, when completed, with about 5 employees.

We have at present, the first of May, 310 meters set, 260 ranges, 130 Humphrey arcs, and are sending out about 21,000 feet through what might be termed the worst season for the gas business, being started too late in the year for both the stove and lighting business.

We have a card index system, giving the name and address of the owner and tenant of every residence in town, as well as business house. We have on this card a complete list of all the gas consuming appliances installed in each building.

We are employing solicitors, giving souvenirs and other advertising novelties, holding demonstrations and offering extremely liberal terms for the acquisition of new business.

Our complaints are taken care of at once, and much care is taken to explain to each consumer the principle and operation of the appliance with which he is having trouble. We expect to inspect all the

appliances yearly in the future. Our employees all wear Company badges.

We were greatly surprised at the quality of the ranges sold to our consumers here, mostly ranges such as the "Cabinet" and "Elevated" ovens predominating at first. A large number of Reflex lights were also among our first installations. We have sold more than 1,200 incandescent burners, and have connected a number of industrial appliances. We had some experience with complaints from leakage, or supposed leakage, at first, but found that gas escaped in some cellars through sewer connections which had no traps on them, and that the so-called gas was mostly from the evaporation of the drip water overflow from our works. After fully developing the business, I think we will not come far from the mark originally aimed at as to consumption and consumers.

The Producer Gas and Gas Engine, with Special Reference to the Down-Draft Producer.

[Prepared for the JOURNAL by MR. THOMAS F. FITZSIMMONS.]

The now generally recognized economy of the producer gas operated engine compels a consideration of this prime mover in connection with almost every new power plant installation.

While in most cases it has been demonstrated, by carefully watching the cost of power, that the producer gas engine is the most economical, yet there are few cases where considerations, other than the direct question of power, make it advisable to retain or select steam, which has for so many years reigned supreme as the great power generator, for all who were blessed with the abundant supply of nature's gift (water power). As the evaporation from earth and ocean is lifted to the clouds, finally condensing to water, falls to the earth, that falling on the more elevated portion naturally drains towards a lower level, and in falling is capable of performing useful work, if properly directed through suitable turbines or water wheels. Even this power is not obtained without important cost, as the dams to retain the water and provide storage, the flumes and penstocks to lead the water to the wheel, and the head gates to control it, involve expenditures for the plant, which may be covered by fixed charges for interest, insurance, taxes and depreciation. Intelligent supervision through attendants for the machinery must also be provided, costing more in some instances per horse power year than a modern gas power plant could produce the same power for.

Accidents sometimes happen to the dams and penstocks, where the accumulated waters (during floods) leap beyond control, and do more serious damage than the wrecking of an entire gas or steam power plant.

Thus, in every power plant equipment it is a question for the careful consideration of experienced engineers to determine, with full knowledge of natural conditions of heat and flow of water, as well as maximum and minimum variations, the price of coal, transportation facilities, availability of suitable labor, etc. It is also important to consider whether there are not operations involving the use of heat which may be more important than the matter of power alone.

Steam has been so commonly used, and we are all so familiar with its applications, that one never realizes that improved means are available for performing nearly all the operations, equally as well and more economically. And, through the same improved means, it is possible to secure power and fuel, as the gas producer will furnish a fixed gas, which will retain its heat value until ignited and burned at the point of combustion, whereas the steam boilers furnish a vapor that loses its heat from the time it is generated.

Did you ever stop to consider that every pound of steam, at atmospheric pressure and temperature of 212° F., contains a total of 1,140 B.T.U., of which 966 are latent, for this amount of heat is absorbed in changing the water to a vapor, hence is not available for useful work? That is only one of the several losses that occur in the production of steam.

Gas can be regulated and controlled with automatic devices, wherever advisable, even more accurately than steam, and with suitable apparatus, nearly the whole temperature difference between the flame temperature, and that of the air is available to the utilizing close to 95 per cent. of the heat value of the gas.

Gas has recently displaced coke in a smelting operation, and at this writing it is assured that several gas smelters will soon be in operation on Cobalt ores. Small and large forgings, tempering and crucible furnaces, case hardening, etc., can be operated by gas more economically than by any other fuel, because of the more uniform product, greater outputs per man and furnace, and the transforming of a dirty forge shop to a clean, light, well-aired shop, due to the absence of coal dust, cinders and smoke.

The gas producer seemingly is the key to the whole situation, making between 55 and 80 cubic feet of producer gas, containing from 100 to 150 B.T.U. per cubic foot, from 1 pound of anthracite, pea or buckwheat coal, having a heat value of 12,000 B.T.U. per pound; that is to say, the gas, when cleaned and cooled ready for the gas engine or furnace, has about 80 per cent. of the actual heat value in the coal.

Anthracite producers are made in the suction type for use with gas engines, putting the work of drawing the gas from the producer into the suction stroke of the engine.

The pressure producer, either with steam blower or fan, delivers air and steam below the fuel bed, the pressure forcing the gas generated through producer and scrubber to the engine or furnaces. Where high pressure is required for furnace gas a booster is sometimes used for raising the pressure on the mains leading to the furnaces. As there are some objections to the pressure producer, necessitating more careful handling, the exhauster system has been quite extensively introduced. With this system a fan exhauster for low pressures, or a positive exhauster when higher pressures are necessary, is introduced beyond the scrubber, taking the cool gas under suction from the producer and delivering it to the mains beyond under pressure.

Any of the above apparatus is suitable for generating gas from anthracite coal, coke or charcoal, and as made by the various manufacturers closely resemble each other, varying slightly in the type of grate used. Grates are sometimes omitted and the waterseal bottom used instead. Nearly all have some method of vaporizing water, generally utilizing for this purpose the sensible heat in the gas before it passes to the scrubber.

As anthracite coal, coke, or charcoal are not always available, several economical designs have been worked out for gasifying bituminous coal, lignite and other fuels, containing considerable quantities of volatiles and heavy hydrycarbons, which with all updraft apparatus are carried over with the gas, wherefore serious difficulty is encountered in cleaning the gas and estimating the tar, which in some coals runs to 300 pounds per ton of coal gasified. This is difficult to market, and is generally utilized for generating steam in an auxiliary boiler for operating exhauster, engine, pumps, etc.

Probably the most superior apparatus for generating producer gas from bituminous and low-grade fuels is of the down-draft type. In its simplest form there is a single generator, in units ranging from 100-horse power to 1,000-horse power each, and these can be banked together in batteries to supply the required aggregate capacity.

Following the generator a waste heat boiler utilizes the sensible heat of the gas for generating steam to operate the exhauster and for regenerating the hydrogen component of the gas. After passing through the tubes of this boiler the gas goes to the wet scrubber, then through the exhauster and dry scrubber to the holder, which is desirable as a reserve supply to meet sudden demands, besides giving the gas made under different conditions of the fuel bed an opportunity to mingle and make a more uniform product.

With this single-unit type of down-draft producer the currents of gas are always in the same direction, and but slight variation of temperature in the different zones takes place. The volatiles and tarry matter, passing down through the incandescent zone of the fuel bed, are all converted into clean, well-fixed gases. No soot, lampblack or tarry products are found in the piping, all of these substances being converted into gas, available for gas engine or furnace work without any mechanical separation or by-products.

This producer is fixed from the top, as the draft is downward. The air which is drawn down through the generator keeps the top cool. The cover is left open, except when the producer is out of service, leaving the fuel bed always in sight of the operator. It is easily fed and worked, permitting the most satisfactory control.

The steam or vapor admission is controlled independent of the air supply, entering as it does the cast iron collar at the top opening, it impinges on the cast iron and does not injure the brick lining. The producer is designed primarily for lean gases, but is equally well suited for water gas, as it is only necessary to close the charging door and open the steam valve to make a run of water gas. The operator soon learns these simple manipulations and easily keeps perfect control of all the conditions. With proper mixture of air and suitable appliances the producer gas made by these generators from bituminous

coals will give temperatures up to 3,000° F. The same gas is suitable for engine purposes, as it will not contain more than 15 per cent. of hydrogen.

In many cases the furnace work is more important than the power and the saving to be made greater. In the absence of bituminous coal anthracite may be used with equally satisfactory results.

Experiences in Changing an Artificial Gas Plant to a Distributing Plant for Natural Gas.

[Read by Mr. P. S. Coate, Manager and Sec'y-Treas., Chatham (Ont.) Gas Company, before the Candian Gas Association.]

During the summer of 1906, while operations were in progress in the southwestern section of the county of Kent, for the development of an oil territory, natural gas was struck in one of the wells at a depth of about 1,400 feet, the flow of gas being of great volume, estimated at about 10,000,000 cubic feet per 24 hours. Shortly after this well was drilled, a second well upon being drilled showed a similar output.

From the nature of the rock, and the depth at which gas was struck, the operators believed that the territory contained a larger gas field. Naturally, the operators immediately began looking about for a market for the gas produced, and Chatham being the nearest place of any size to the field, many applications were made to the City Council for franchises for the use of the streets for distributing gas. Before, however, any franchise was granted, the Company which the writer represents entered into an agreement with the operators, who seemed to have the best output of gas and the best territory under lease for the distribution of the gas, on a percentage basis; that is, my Company was to distribute the gas within the city, install all the necessary apparatus within the city such as high pressure lines, regulators, etc., collect the accounts, in fact, have complete control of the business within the city, and to pay to the operators or natural gas producers a certain percentage of all receipts. Under the terms of the agreement it was necessary for my Company to properly maintain the distributing mains without leakage, etc.

Now a proposition, such as making a complete change from artificial gas manufacture and distribution to distribution of natural gas from an untried field, is without question a staggering one. It was a question in the mind of the writer whether or not to advise the directors of the Company to invest a comparatively large amount of capital in the necessary high pressure mains, regulators, etc., for the distributing of natural gas when the field might prove of little value, yet, if the supply of gas should prove to be large and lasting, there seemed to be no question that to control the distribution was the proper thing to do. A dark cloud on the horizon was the fact that the artificial gas plant had been in operation in Chatham since 1872, and many of the mains had been in the ground since that time. Natural gas is distributed at about four times the pressure that artificial gas is distributed, so that the writer had visions of leakages *ad infinitum*, a particularly pleasant prospect. There were about 500 3-light prepayment meters installed for artificial gas, the prepayment devices of which could not be changed, so the manufacturers informed us to operate at a price as low as 25 cents or 35 cents per 1,000 cubic feet. This was another pleasant prospect.

A large proportion of the gas stoves in use in artificial gas conditions was of one particular make, and, upon corresponding with the manufacturers, we were informed that these stoves could not be used for natural gas without first having them all returned to factory and having them entirely reconstructed. It will be admitted that the clouds on the horizon were becoming heavier.

It was known that when the change from artificial gas distribution to natural gas was made it would be made instantly, and while temporarily at least the same quantity of natural gas would be sold as had been sold of artificial gas, the revenue of the Company would be reduced from an average price of $1.20 per 1,000 cubic feet to 25 cents and 35 cents per 1,000 cubic feet, out of which latter prices a large proportion would have to be given to the producing Company under our agreement, and, since the revenue derived from natural gas is almost wholly obtained from gas sold for heating purposes, it was known that some time must elapse before enough connections to heating stoves and furnaces could be made to produce a respectable return.

When shareholders are in the habit of receiving half-yearly dividends promptly, they are liable to make serious objection to any deviation from the ordinary course of events; therefore the prospect in this case was not of the pleasantest nature. Under the terms of our franchise it was necessary for us to supply gas for illuminating purposes. Now, unfortunately, the natural gas as supplied to Chatham contains a large proportion of sulphuretted hydrogen, and since the Dominion statutes prohibit the sale of gas for illuminating purposes which contains sulphuretted hydrogen, still another pleasant prospect appeared before us.

Such was the situation when natural gas was first taken to be distributed in Chatham. However, it was finally decided that our Company should go boldly into the matter and do the best that could be done under the circumstances. The first thing to do, as the writer understood it, was to make connections as rapidly as possible to the largest consumers of gas. There being a large supply from the field, and under our agreement we had the privilege of furnishing gas to manufacturers for steam boilers, our first idea was to install high pressure lines to the manufacturers, so that the revenue might be increased as rapidly as possible. The work of laying high pressure mains on the entrance of the city to the manufacturers was gone on with immediately. At the same time a large force of gasfitters was imported from Buffalo and other places, and immediately set to work to make connections to house furnaces and to cooking ranges in the private houses. It was decided to first introduce the natural gas into the mains of our Company in the month of March, believing that, by doing this, the following summer would be before us for the installation of burners in furnaces and ranges, etc., and that by the following winter we could have a large number of houses connected, and that we would by that time receive considerable revenue from the sale of gas in residences for heating purposes.

These installations were made both in the factories and private residences with such success, that, for the year ending June 30th, the fiscal year of the Company, the revenue was such that it was not necessary to pass the regular dividend.

The Company was fortunate in having laid, about 3 years previous to the introduction of natural gas, large feeder mains of wrought iron through the center of the city, both east and west and north and south. These mains were 8 inches in diameter and provided splendid means of distributing the gas throughout the city. While first it was thought that many leakages would be found in the distributing mains, the Company was fortunate in having very few mains of cast iron after the distribution of natural gas began. While some little leakages occurred in portions of the city, these proved very few in number and were easily repaired. The prepayment devices to the meters which I have mentioned were moved entirely, and these meters were used in small houses, where the consumption of gas was not to be great, just as an ordinary meter would be used. In nearly all residences where gas was used in furnaces, 5-light special capacity meters were installed, and have since proved to be entirely satisfactory in every respect. For larger residences and factories Tobey meters and proportional meters were used with good results. The gasfitters we had imported from Buffalo believed that the gas stoves could be used for the use of natural gas by changing the position of the burners and by using closed tops on these stoves. This change was tried and found to work fairly satisfactorily, and finally overcome the trouble we expected to have experienced in the gas stove question.

The troubles as outlined above having been overcome, the principal remaining trouble was the impurity of the gas. In making our agreement with the producing company, we fortunately had inserted a clause by which the producing company agreed to deliver the gas of the quality that could be legally sold for all purposes. It was, therefore, necessary for the producing company to install purifiers of sufficient capacity to purify all of the gas that was sold for domestic heating purposes as well as for illuminating purposes, since the gas for both these purposes was distributed through the same main. Having overcome all our supposed troubles, we were able to settle down to the ordinary distribution of the gas and to devote our attention to the quality of the service given in different sections of the city.

The gas is brought into the city from a field for a distance of about 15 miles through a 6-inch wrought iron pipe at a pressure of about 200 pounds. At the entrance to the city the pressure is reduced from 200 pounds to 80 pounds, by high pressure regulators. From this point gas is carried through different sections of the city through 3 high pressure mains, each 3 inches in diameter. These high pressure mains not only carry the gas to regulators at 6 different points in the city, but they also deliver gas to all the factories in the city. The

gas delivered to the factories is reduced in pressure at each factory by individual regulators. With this system of distribution, although we have already passed through two winters, the services given to our customers has been absolutely satisfactory in every respect, and we have been fortunate enough to experience, during the past few years, only two breaks in the line from the field, and these breaks were repaired in each case within an hour or two.

The Company which I represent operates the electric lighting plant for this city as well as the gas plant, and we were fortunate enough to have installed, at the time that natural gas was introduced, gas engines in which artificial gas had been used, which provided a motive power for our electric generator.

In our agreement with the Producing Gas Company, we obtained a special rate for the gas we were to use for our own purposes, and the gas used in the gas engines reduced the cost of fuel to such an extent that it would compare favorably with the cheapest water power in existence. It was found that the economy in using the gas as fuel in gas engines was so great that we have since entered into an agreement with the Chatham, Wallaceburg and Lake Erie Railway Company, to supply all the electric current they require on their road. The gas engine plant for this purpose is now being installed, and we believe it will provide a valuable source of income to the Company.

The above are a few experiences in the changing of artificial gas plant to a distributing plant for natural gas, and from the experiences, it will be seen, as in most cases, no matter how heavy the clouds appear on the horizon, these clouds always have a silvery lining.

Bureau of Information, The American Gas Institute.

Under the direction of the Institute it has been decreed: 1. That the privilege of submitting questions be limited to members of the Institute. 2. Neither the Board of Directors of this Institute, nor the Institute as a body, make themselves in any way responsible for the statements of fact or expressions of view given out by the Bureau of Information.

BUREAU OF INFORMATION, THE AMERICAN GAS INSTITUTE, HEADQUARTERS, 1943 COMMERCIAL NATIONAL BANK BUILDING. W. A. PAEHR, Chairman. CHICAGO, ILLS., June 22, 1909.

The Bureau submits the following self-explanatory budget:

Question No. 54.—"In the matter of gas arc lamps owned by gas companies and rented to consumers, are there any cases where the rental systems has proven satisfactory, or where any other system has proven more satisfactory?"

ANSWER-AT-LARGE.

By Mr. S. B. Stewart, General Contracting Agent, Philadelphia Company, Pittsburgh, Pa.—A straight rental system can never be the ideal system, principally for the reason that the consumer does not give the lamps the care and attention necessary to maintain them at their full efficiency. No lamp, no matter how well constructed or perfectly adjusted, will remain in good condition unless properly cared for. The average consumer knows very little about the mechanical construction of the lamps and is not properly equipped to give them the attention they require.

The most practical and satisfactory way to handle lamps is to furnish them for the use of the consumer without any rental charge, but with an agreement that a specified sum is to be paid the company each month for maintenance, in consideration of which, the company takes care of the lamps and keeps them in good condition. The company selling the gas is vitally interested in the efficiency of the lamps, and should, therefore, clean, repair and inspect them at regular intervals. Practically, every consumer would be willing to pay a monthly charge for such maintenance for a good, satisfactory light. Where the artificial gas company has keen competition, especially from cheap natural gas, neither the rental nor the maintenance charge can be made; but, even under such circumstances, the company should place lamps and maintain them absolutely free of charge.

If the maintenance department is placed on a good, systematic basis, this maintenance should never exceed 30 cents per month and will often be as low as 22 cents or 23 cents. Even with such free maintenance the company will find it to be of great advantage to them to handle lamps.

Answer by Mr. H. F. Parcher, Manager, Appliance Store, Springfield (Mass.) Gas Light Company.—Six years ago the Springfield Gas Light Company instituted a system of putting in arc lamps, on a rental system at 60 cents per month, which was to pay for a bi-montlhy inspction and cleaning; also to pay the gas company interest and depreciation on the price of the lamp. Soon after, when lamps were reduced quite materially in cost, this price was changed to 25 cents per month.

The system had many objections, one of which was the tendency of the applicant to order his lamps out at the approach of hot weather, which, our experience showed, depreciated the lamp more than 3 or 4 years of constant use, and which entailed a considerable amount of breakage of glassware.

Another objection was that, in some cases, where an installation of 100 or more lamps was made, the applicant did not consider it fair to charge them the same price per lamp as some consumer who used only one or two, and in most of these cases the user of the lamps would ask for permission to take care of his own, supplying his own mantles and glassware.

The Company soon after numbered their lamps, with progressive numbers, similar to the meter numbers, and commenced putting lamps in without charge, which system has been followed, and is being continued at the present time; the trimmers cleaning the lamps without charge, simply charging for mantles and glassware, where furnished, at a profit of from 50 to 100 per cent.

In Springfield we find the last method proved most satisfactory of them all, as we continue to hold most of the business during the summer months. If we do not get it all, we at least get a part of the lighting. In the early fall the lamps come into constant use again. The expense of taking them down and hanging them up is entirely done away with, and the returns, from profit and mantles and glassware, are almost as much as where rental is charged.

The Company has used for several years one make of arc exclusively, although at the commencement several different types were used, and although the lamps have been depreciated several times, there have been none of this one make put into the scrap heap, although some of them have been sent to the factory and have been refinished.

Answer by Mr. D. D. Barnum, Worcester (Mass.) Gas Light Company.—Our experience with the rental and maintenance of gas arc lamps has been very satisfactory indeed; it has worked better than any other method we have tried. The success of gas arc lamps depends almost entirely upon their being properly cared for, and if the gas company owns and cares for them this can be accomplished, whereas if they are owned by the consumer they are seldom given the care they require.

Question No. 47.—"Can you furnish me with information as to the results, under ordinary working conditions, of the yield of creosote oils per gallon of coal gas tar, and also per gallon of water gas tar?"

ANSWER BY BUREAU.

In securing an answer to this question the Bureau was confronted by some technical difficulties. In the first place the following is to be noted:

In Circular No. 96, U. S. Department of Agriculture, Forest Service, entitled "Quantity and Character of Creosote in Well Preserved Timbers," Dr. Gellert Alleman makes the following statement:

"Technically speaking, the fraction of oil passing over between 240° C. and 270° C. during the first distillation of the crude coal tar is known as 'creosote oil,' 'heavy oil,' or 'dead oil of coal tar.'"

And, further:

"The creosote oil of commerce contains phenol (carbolic acid), the ortho, meta and para cresols, naphthaline, the A and B methyl-naphthalines (the former being a liquid, the latter a solid, melting at 33° C.), anthracene, phenanthrene, acridene, and small quantities of certain high boiling bases and acids."

Accepting the foregoing as covering the definition of a creosoting oil, there is none obtainable from water gas tar, since this tar will yield no phenols or cresols.

If the inquirer wishes to know whether there is any wood preserving oil obtainable from water gas tar, then the answer would be different. Practically, however, if we interpret the question so that the inquirer merely wished to know how much oil, heavier than water, can be obtained from coal gas and water gas tar, the question is more easily answered. The general run of experiences of coal tar distillers is that about ½ of a gallon of oil is obtained from 1 gallon of coal tar. This includes both light and heavy oils.

As a practical example a certain coal tar made from Youghiogheny coal gave the following results: The yield of creosote oils from coal tar amounted to 22 per cent. and from water gas tar to 29 per cent. Chemically, however, the coal gas tar showed only 4 to 5 per cent. of creosote and carbolic oils, while the water gas tar yielded none.

It may be stated that, in creosoting plants where oils from water gas tar are used, it is customary to mix them with coal gas tar oils, in such proportions as may be specified by the purchasers of the creosoted timber.

ANSWER-AT-LARGE.

By Mr. Carroll Miller, Pittsburgh Pa.—The percentage of creosote produced will vary with the quality of the tar and the coal from which it is produced. An ordinary retort house tar, specific gravity 1.21, containing about 20 per cent. of free carbon, will yield in the neighborhood of 24 per cent. by weight of middle, heavy and anthracene oils, which will amount to 60 gallons of creosote per ton (2,240 pounds) of tar. The specific gravity of this creosote will be about 1.05. However, if the specifications are very strict the yield of creosote will probably be less, as it is very doubtful if the whole of these oils can be used for producing a creosote of the required quality. For details and specifications, see Circulars Nos. 60 and 112 of the U. S. Department of Agriculture, Forest Service. For reasons mentioned above, no definite figures can be given for the yield of creosote from any particular tar unless details regarding the tar and the quality of creosote desired are stated.

From 40 to 50 per cent. by volume of middle, heavy and anthracene oils are obtained from water gas tar produced from Pennsylvania gas oil. The quality and quantity of the creosote will vary in accordance with the quality of the oil and the temperature at which it is gasified.

Items of Interest
FROM VARIOUS LOCALITIES.

"J. K. S.," writing to us under recent date says: "Mr. C. E. Paige, Superintendent of the Malden and Melrose (Mass.) Gas Light Company, became a benedict not long ago. He got away before his men were thoroughly awake to the change in his way of living; but they did celebrate his return from the honeymoon trip by handing him a neat little package that contained $190 in new gold coins. The presentation was made by a committee from the works, who were highly edified—maybe they were amused, too—by the changes in Mr. Paige's countenance while the giver was making his presentation speech."

THE reconstruction of the gasoline vapor gas plant and its changing over to a modern water gas plant, for the Monroe (Wis.) Lighting and Fuel Company, is under the direction of Mr. Frank D. Moses, President of the Gas Engineering Company, of Trenton, N. J.

"B. R. R.," writing under date of the 24th inst., from Salem, N. H., remarks: "I failed to note any mention of the outing we recently had, and so inclose you this cutting from the Boston *Globe*, of June 20th: The Association of Managers, Superintendents and Employees, of the Malden and Melrose Gas Light Company, the Malden Electric Company, the Suburban Gas and Electric Company, the Concord (N. H.) Electric Company, the Haverhill Electric Company, the Springfield Gas Light Company, the Exeter and Hampton Lighting Company and the Exeter and Hampton Street Railway Company, held its annual meeting at Canobie Lake Park, the afternoon of June 20th. The Boston members made the trip by trolley in special cars. Luncheon was served on the arrival of the party, after which came the many sporting trials which had been arranged for. The general Committee-in-charge consisted of Messrs. J. B. Burnett, G. W. Stiles and B. F. Pierce. The judges of the athletic events were H. A. Gidney, L. W. Bridges, H. T. Sands and A. B. Tenny, who is General Manager of the Companies named, and who is also President of the Association. The winners and contests, briefly summarized, are as appended: 75-yard dash, T. F. Wilson, winner; broad jump, F. A. Willen; putting-the-shot, won by J. M. Gidney; sack race, 60 yards, won by A. E. Vaughan—Mr. Tenny was second in this contest. The 600-yard run was won by R. F. Lakti. At 6 o'clock an excellent c ambake was served."

Mr. W. V. SPINNING has resigned from the service of the Wabash Valley Gas Company, Peru, Ind. We understand that no successor will be appointed, his duties having been put over to the responsible shoulders of Mr. G. M. Dolley, Manager of the Peru (Ind.) American Gas Company.

AT the annual meeting of the shareholders in the Ottawa (Ills.) Gas Company, which is largely controlled by capitalists resident of Wilkes-Barre, Pa., the proceedings were colored with the knowledge that the year had been a good one. These tidings naturally paved the way to re-electing the following gentlemen: Directors, A. F. Schoch, C. E. Hook, V. J. Duncan, John Flanigen, B. C. Allen and George Powell; President, John Flanigen; Vice-President, C. E. Hook; Secretary-Treasurer, B. C. Allen, Wilkes-Barre.

AT the last meeting of the Directors in the Beverly (Mass.) Gas and Electric Company, it was ordered: "In accordance with the custom of this Company to reduce the price of lighting as fast as the conditions of the business will allow, we are pleased to inform our patrons and the public, that at the last meeting of our Directors it was voted that, on and after July 1, 1909, the net price of gas be reduced from $1.20 per 1,000 cubic feet to $1.15 per 1,000 cubic feet, and the gross price be reduced from $1.40 per 1,000 cubic feet to $1.35 per 1,000 cubic feet, with a discount of 20 cents per 1,000, when bills are paid on or before the 15th day of the month in which they are presented." Good men and true are these Beverly men.

THE official gas testing quarters of the Gas Inspection Bureau, of Chicago, have been located at 71 Fifth avenue, and the paraphernalia thereof is of the most modern sort. We understand that Mr. J. C. Dickerman, of the University of Wisconsin, has been appointed Official Inspector. The salary attached to the position is $2,500.

WE are informed that the Utilities Company, of Philadelphia, has purchased the entire capital stock of the Mifflin County (Pa.) Gas and Electric Light Company.

THE Kansas Natural Gas Company, some days ago, notified the mine operators of the Joplin, Mo., mining district, that on and after December 15th, it will cease to supply gas as fuel for use under ordinary boiler furnaces. Inadequate pipe line facilities is given as the reason for this order, but many think (and it looks to us with good reason) that the impelling force is the wish to cause the more general introduction of gas engines. Certainly this would be a good move, for many great volumes of natural gas would be saved in this way—*i. e.*, as between force generated in and from the ordinary boiler and the completed modern gas engine.

THE Western United Gas and Electric Company has decided to extend its mains to and through the settlement of Lemont, which could easily be done by extending the high pressure line from Lockport.

MR. FRANK FLAVELL, Secretary of the Cruse-Kemper Company, of Philadelphia, recently tendered that corporation his resignation, in order that he might engage in the selling of bonds, stocks, etc. Mr. Lawrence W. Bigg, heretofore Chief Accountant for the Company since its organization, was elected Secretary. Both gentlemen are certainly worthy of their advancements, and it may be taken for granted that Mr. Flavell will have no better wellwisher in his new field than Mr. Arthur R. Cruse, and that Mr. Biggs will have no better supporter than the Company which has promoted him solely from merit account.

THE Massachusetts Board of Gas and Electric Light Commissioners has approved the petition of the Milford Electric Light and Power Company for the right to issue 20 year bonds, in the sum of $40,000, to cancel outstanding obligations and to raise funds for reconstruction work, now underway. The bonds are of the 5 per cent. interest bearing order.

MR. L. P. LOWE, President of the Economic Gas Company, of Los Angeles, Cal., writing under date of the 23d inst., says: "It will be an appreciated favor if you will kindly make mention in your reading columns of the fact that this Company will be glad to receive catalogues, price lists, etc., from all manufacturers of gas consuming appliances."

"BAKER," writing from Newark, N. J., under date of the 29th inst., incloses the following: "A committee of 17 citizens has been

charged with the duty of ascertaining whether the residents of Madison, N. J., desire the construction of a gas works, to be operated on municipal account, or whether the borough of Madison shall award to the Morristown Gas Light Company the right to supply gas in Madison. The committee has been instructed to hand in its report at the meeting called for July 12th."

MR. A. H. CALKINS has been elected Superintendent of the Galveston (Tex.) Gas Company, vice Mr. John Gimper, resigned. Mr. Calkins was formerly connected with the manufacturing division of the San Antonio (Tex.) Gas Company.

THE Improved Equipment Company has been appointed sole selling agent for the Dessau System of Vertical Rétorts in the States of Wisconsin, Indiana, Michigan, Illinois, Ohio, Louisiana and all the States West of the Mississippi river.

"T. J. R.," is informed that the annual meeting of the Consolidated Gas Company, of Long Branch, N. J., will be held the afternoon of Thursday, July 8th, at its offices on Broadway, Long Branch.

ATTORNEYS AMMERMAN AND MASIC, of Scranton, Pa., on behalf of the J. G. White Company, recently filed a petition in the Federal Court for the district, asking that the Berwick (Pa.) Consolidated Gas Company be put in the hands of a receiver, which action was largely precipitated by the statements of one A. C. Sickels. The court acceded to the request and Messrs. S. C. Jayne and W. E. Barrett were appointed as such.

DESPATCHES from Wilmington, Del., dated the 28th inst., are to the effect that the Messrs. Dobson have parted with their ownership of the Wilmington (Del.) Gas and Electric Company, to a syndicate composed of Messrs. C. H. Geist, C. McCormack, C. H. Dawes and Knowlton Ames. The consideration is said to have been $1,500,000.

MR. ROGER W. POLK, Gas Engineer to the Laclede-Christy Clay Products Company, of St. Louis, Mo., informs us that the Products Company is under contract to erect a new bench of recuperative 6's at Aberdeen, Wash. Other contracts on the books call for through benches of 8's, Charlestown, Mass; also, for benches at Brandon, Manitoba, and Fort Worth, Tex. These agreements certainly go to show that the Company s territory, in respect of taking and finishing contracts, knows little as to boundary limits.

SOME time ago we noted the incorporation of the Sumter (S. C.) Gas and Light Company, capitalized in $50,000, and officered as follows: President, E. B. Wright; Vice-President and General Manager, J. L. Alnut; Secy.-Treas., A. D. Turner. Mr. Alnut advises us that contractors for gas machinery should address him at once (at Sumter) respecting particulars.

THE annual meeting of the Burlington (Vt.) Gas Light Company will be held in that city at noon to-day. It should certainly be a rousing meeting, especially if the youngsters of Burlington manage to keep their powder dry up to 11 A.M.

GEORGE A. SCHMELZ, of the Schmelz Brothers, of Newport News, Va., who bought in the plant of the Hampton and Phœbus Gas Company, of Hampton, Va., paying therefor the sum of $87,500, says that an operating Company, backed largely by local capital, will develop the business to the fullest possible degree.

THE use of 7,000,000 feet of gas, for balloon ascension purposes by the Aero Club of America in 1908, entitles this country to send 8 delegates to the International Congress of Aero Clubs, to be held next month in Milan, Italy.

ON June 28th bids for the public lighting contract of Boston, Mass., by gas, were opened in the office of Superintendent of Streets Emerson, and the bids were only two in number. Our information respecting the matter (as follows) is from the Boston *Post*, 29th ult.: "The bidders were the Greater Boston Illuminating Company, and the Rising Sun Company. The former corporation, which was recently organized, and is a new competitor in the street lighting field, underbid the Rising Sun Company, which has held the contract for several years. Under the bid of the Greater Boston Company, Supt. Emerson figures that Boston will get its street gas lighting done for about $50,000 less per year than it is now paying. The new Company, too, promises to give the city three times as much light as it is now getting under the old contract. Its bid, on a basis of 12,000 lamps, was $236,790 per year for inverted incandescents against $266,600 for vertical and $271,240 for inverted lamps, the bid of the Rising Sun Company. The Greater Boston Company bid for 6,000 lamps, or half the total number, and also for the full number, 12,000. This Company made only one form of bids, namely, to furnish both the gas, the lights and the care of the same, while the Rising Sun Company submitted two forms of bids, one for the lights and care of the same alone, and another to furnish the lights, care and gas. The Greater Boston Company bid to furnish 6,000 60-candle power lamps with a single incandescent burner, and with gas for $22.25 per lamp. The Rising Sun Company did not bid for 6,000 lamps. On the basis of 12,000 lamps the Greater Boston Company agreed under its bid to furnish lamps of 60-candle power for $20.49 per lamp with gas; to furnish lamps with 2 incandescent burners, each yielding 60-candle power for $35 for gas, and to furnish open flame, fire alarm single lamps with gas for $22 per lamp. The Rising Sun Company bids for the work were $23.60 for furnishing gas and $14 without gas, for an upright lamp, and $24.10 and $14.50 for inverted lamps; $35.80 and $16.60 for uprights, and $36.20 and $17.20 for inverted lamps. The Rising Sun Company agreed to care for the fire alarm lamps without furnishing the gas, for $10.50. At present the city is paying the Rising Sun Company $15.60 per lamp per year. It buys its own gas and pays $9.36 per lamp per year, which brings the total cost to the city per lamp per year, under the present contract, up to $24.96. This is for single lamps. While under the recent big street electric lighting contract the Company agreed to put in 60-candle power tungsten lamps for $22.31 per lamp per year, it has been learned that this Company would not be willing to do the work asked for under the proposed new contract at this figure unless it got a 10-year contract."

THE Isbell-Porter Company is about ready to ship the new purifying boxes that it is to set in place in the municipal plant at Holyoke, Mass. A workman in the Company's shops that is building the boxes said the other day to the writer, "Mr. * * *, those Holyoke boxes are sure enough beauties."

MANAGER CLARKE, of the Paris (Ills.) Gas and Electric Company, failing to strike, at a depth of 700 feet, a good flow of water in the well that the Company is sinking, declares they will go to 1,400 feet before they give up.

THE Waynesboro (Pa.) Gas Company has arranged for the extension of its mains to and through the settlement known as South Waynesboro.

MR. A. D. CRESSLER, and that big son of his, are under contract to construct storage holders for the Indiana Lighting Company at Frankfort, Lebanon, Decatur and Lafayette.

THE Trustees of the Massachusetts Gas Companies have set aside the sum of $750,000 to be used in stock dividends for the fiscal year ending June 30, 1910. This concurs with the action taken in 1909, during which period 3 dividends (4 months apart) of 1 per cent. were declared. The Directors of the Boston Consolidated Gas Company have declared a quarterly dividend of 2 per cent. and an extra of ½ per cent., thus putting the shares on a 9 instead of an 8 per cent. basis.

MR. E. W. SOMMER, official Gas Inspector for Milwaukee, Wis., in his report respecting the operations of his office for the twelvemonth ended June 1st, 1909, says that the gas furnished by the Milwaukee Company is fairly uniform in composition and compares well with the gas supplied in nearby cities. Complaints about gas meters have been promptly attended to, and it has been determined that the meter is a far better measurer, as to correctness, than many other measurers in ordinary use. The pressure never falls below that prescribed by the statutes, and the monthly average illuminating power (16 candles) set out by law was never found in default.

THE Vera (Kas.) Gas Company has been organized to supply gas in that settlement. It is capitalized in $25,000, and its Directors are Messrs. W. J. Lucy, James A. Veasey and L. A. Rowland.

THE AMERICAN GAS LIGHT JOURNAL

The Market for Gas Securities.

Some recovery in quotations for Consolidated gas is reported, which recovery was accomplished in the face of rather free offerings for this particular stock. At noon to-day (Friday) the figures were 140 to 140¼. Our prediction of a month ago in reference to Consolidated holds good.

Brooklyn Union is again virtually on a parity with Consolidated, being 139½ to 141. Peoples, of Chicago, is 115 bid, and Massachusetts Gas Companies, especially the preferred, keeps going up in even manner. The bond market is quite active.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY.

JULY 5.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share:

N. Y. City Companies,	*Capital*	*Par.*	*Bid.*	*Asked.*
Consolidated Gas Co.	$78,177,000	100	140	140¼
Central Union Gas Co.—				
1st 5's, due 1972, J. & J.	3,000,000	1,000	98	101
Equitable Gas Light Co.—				
Con. 5's, due 1932, M. & S.	1,000,000	1,000	—	105
Mutual Gas Co.	3,500,000	100	155	165
New Amsterdam Gas Co.—				
1st Con. 5's, due 1948, J. & J.	11,000,000	1,000	100	101½
New York & Richmond Gas Co. (Staten Island)	1,500,000	100	37	43
1st Mtg. Gold Bds. 5 p. ct.	1,000,000	—	100	101
New York and East River—				
1st 5's, due 1944, J. & J.	3,500,000	1,000	104	107
Con. 5's, due 1945, J. & J.	1,500,000	—	97	101
Northern Union—				
1st 5's, due 1927, J. & J.	1,250,000	1,000	94	100
Standard	5,000,000	100	—	75
Preferred	5,000,000	100	70	100
1st Mtg. 5's, due 1930, M. & N.	1,500,000	1,000	100	105
The Brooklyn Union	15,000,000	1,000	139½	141
1st Con. 5's, due 1948, M. & N.	15,000,000	—	91½	92
Yonkers	999,650	500	180	—
Out-of Town Companies.				
Bay State	50,000,000	50	¾	⅞
" Income Bonds	2,000,000	1,000	—	75
Binghampton Gas Works	450,000	100	—	65
" 1st Mtg. 5's	500,000	1,000	90	98
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	5	8
Bonds, 5's	5,250,000	1,000	60	60¼
Capital, Sacramento	500,000	50	—	35
Bonds (6's)	150,000	1,000	—	—
Chicago Gas Co. Guaranteed Gold Bonds	7,660,000	1,000	104	106¼
Cincinnati Gas and Electric Co.	29,500,000	100	92	93
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	96	98
Columbus (O.) Gas Lt. & Heating Co.	1,682,750	100	90¼	91
Preferred	3,026,500	100	75½	80
Consumers, Toronto	2,000,000	50	200	204
Consolidated, Baltimore	11,000,000	100	—	105
Mortgages, 6's	3,600,000	—	—	118
Chesapeake, 1st 6's	1,000,000	—	—	—
Equitable, 1st 6's	910,000	—	—	—
Consolidated, 1st 5's	1,490,000	—	—	112
Consolidated Gas Co. of N. J.	1,000,000	100	15	17
Con. Mtg. 5's	880,000	1,000	92	95
Bonds	75,000	—	—	100
Denver Gas and Electric	458,000	—	102	105
Detroit City Gas Co	5,000,000	50	—	50
" Prior Lien 5's	4,619,000	1,000	97	100¼
Detroit Gas Co., 5's	381,000	1,000	75	80
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	—	101
Essex and Hudson Gas Co.	6,500,000	—	39	40
Fort Wayne	2,000,000	—	—	—
" Bonds	2,000,000	—	55	—
Grand Rapids Gas Light Co., 1st Mtg. 5's	1,225,000	1,000	104½	105
Hartford	750,000	25	190	200
Hudson County Gas Co., of New Jersey	10,500,000	—	112	113½
" Bonds, 5's	10,500,000	—	103	103½
Indianapolis	2,000,000	—	60	70
" Bonds, 5's	2,650,000	—	104½	105
Jackson Gas Co.	250,000	50	82	—
" 1st Mtg. 5's	250,000	1,000	97	100
Kansas City Gas Light Co., of Missouri	5,000,000	100	—	96
Bonds, 1st 5's	3,822,000	1,000	102	104
Laclede Gas Co., St. Louis.	10,000,000	100	—	100
Preferred	2,500,000	100	60	90
Bonds	10,000,000	1,000	104	104¼
Lafayette Gas Co., Ind.	1,000,000	100	—	60
Bonds	1,000,000	1,000	60	65
Louisville	2,370,000	50	143	145
Madison Gas and Electric Co.				
" 1st Mtg. 6's	350,000	1,000	106	108½
" 6 per cent. scrip, due 1910	100,000	25	60	60½
Massachusetts Gas Companies, of Boston	25,000,000	100	63	63¼
Preferred	25,000,000	100	90	—
Montreal Gas Co., Canada	3,000,000	100	218	218¾
Nashville Gas Light Co.	1,000,000	100	110	—
Newark, N. J., Con. Gas Co.	6,000,000	—	56	58
Bonds, 6's	6,000,000	—	137	138
New Haven Gas Co.	2,000,000	25	200	—
Peoples Gas Lt. & Coke Co., Chicago	25,000,000	100	114½	115
1st Mortgage	20,100,000	1,000	—	—
2d "	2,500,000	1,000	104	—
ochester Gas & Electric Co.	2,150,000	50	88	—
Preferred	2,150,000	50	118	—
Consolidated 5's	2,000,000	—	104½	105½
San Francisco Gas Co., Cal.	15,500,000	—	—	—
St. Joseph Gas Co.—				
1st Mtg. 5's	751,000	1,000	100	102
St. Paul Gas Light Co.	1,500,000	100	45	47
1st Mortgages, 6's	650,000	1,000	113	116
Extension, 6's	600,000	1,000	112½	115
General Mortgage, 5's	2,465,000	1,000	90	95
Syracuse Gas Co., N. Y.	1,975,000	100	50	55
Bonds	2,047,000	1,000	100	101
Washington (D. C.) Gas Co.	2,600,000	20	350	352
1st Mortgage, 6's	600,000	—	—	—
Western Gas Co., Milwaukee	4,000,000	—	—	—
Wilmington (Del.) Gas Co.	600,000	50	220	—

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Maryland Meter and Mfg. Co., Baltimore, Md. 46
Metric Metal Co., Erie, Pa. 47
Nathaniel Tufts Meter Co., Boston, Mass. 46
New York Improved Meter Co., New York City. 46
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Rotary Meter Co., New York City. 19
Sprague Meter Co., Bridgeport, Conn. 45
United States Meter Co, Brooklyn, N. Y. 47

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American Meter Co., New York and Philadelphia. 47
D. McDonald & Co., Albany, N. Y. 45
Helme & McIlhenny, Philadelphia, Pa. 47
John J. Griffin & Co., Philadelphia, Pa. 1204
Keystone Meter Co., Royersford, Pa. 46
Nathaniel Tufts Meter Co., Boston, Mass. 46
New York Improved Meter Co. New York City. 46
Pittsburg Meter Co., East Pittsburg, Pa. 30
Sprague Meter Co., Bridgeport, Conn. 45

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G. A. Bronder, New York City 27
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Davis & Farnum Mfg. Co., Waltham, Mass 40
Isbell-Porter Co., Newark, N. J 28
Kerr Murray Mfg. Co., Fort Wayne, Ind 41
Quintard Iron Works, New York City 29
R. D. Wood & Co., Philadelphia, Pa 42
Stacey Mfg. Co., Cincinnati, O 43
The United Gas Improvement Co., Philadelphia, Pa. . 35
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Davis & Farnum Mfg. Co., Waltham, Mass 40
Economical Gas Apparatus Construc. Co., Toronto, Ont. 18
Isbell-Porter Co., Newark, N. J 28
Kerr Murray Mfg. Co., Fort Wayne, Ind 41
Ludlow Valve Manufacturing Co., Troy, N. Y 40
R. D. Wood & Co., Philadelphia, Pa 42
Stacey Mfg. Co., Cincinnati, O 43
The Gas Machinery Co., Cleveland, O 20
The P. H. & F. M. Roots Co., Connersville, Ind 31
Western Gas Construction Co., Fort Wayne, Ind 48

(*Continued on page* 18.)

DIVIDEND NOTICE.

OFFICE OF THE UNITED GAS IMPROVEMENT CO., N. W. CORNER BROAD AND ARCH STS., PHILADELPHIA, PA., June 9, 1909.

The Directors have this day declared a quarterly dividend of 2 per cent. (one dollar per share), payable July 15th, 1909, to stockholders of record at the close of business, June 30, 1909. Checks will be mailed.

1775-5 LEWIS LILLIE, Treasurer.

Position Wanted.

A young man wants to make a change, preferably to a company where a knowledge of gas manufacture can be obtained. Has been employed for past two years as new business manager of a gas company in a town of 12,000 inhabitants, and of necessity has had to turn a hand to every side of the gas distribution, as well as to look after an appliance store, fitters and stock. The applicant is a student of the American Gas Institute, a high school graduate, 24 years old and unmarried.

Address, "CENTRAL,"
1778-2 Care this Journal.

POSITION WANTED AS MANAGER.

Gas lighting or new business departments. Thoroughly familiar with all appliances, for both lighting and heating, their construction, installation, operation and sale, with the buying of same, etc. Have had 12 years' experience on both natural and artificial gas, also main line construction and services, house piping, etc. Would prefer locating in the South. Can get the business and show results. State salary in first letter. Address, "BUSINESS,"
1778-4 Care this Journal.

Position Wanted
As Superintendent,

By a competent gas man who has had practical experience in all branches of the business, both coal and water gas. At present employed. A-1 references.

1755-tf Address, "R. C.," care this Journal

Position Wanted
As Manager or Superintendent,

By a man who has had experience and is familiar with the manufacture and distribution of coal and water gas and can deliver the goods. Address, "O. K.,"
1777-2 Care this Journal.

WANTED,

For Western territory, an aggressive and competent traveling salesman for a leading line of gas ranges and heaters. State age and experience.

Address, "MANUFACTURER,"
1767-tf Care this Journal.

WANTED,
COMPETENT DRAFTSMAN.

Must have thorough knowledge of gas bench designing. Position permanent and salary liberal for right party. State experience.

1775-tf Address, "BENCH," care this Journal.

WANTED,
Foreman for Coal Gas Plant in Middle West.

Must be thoroughly reliable and understand the handling of men and the recovery of ammonia. Good situation to right man.

Address, "B. B.,"
1778-2 Care this Journal.

WANTED,
STREET MAIN FOREMAN.

One who can take charge of laying pipe up to 16-inch. Must be well recommended. Give age, experience, references, and wages expected. City of 30,000, within 2 hours of New York.

1778-1 Address, "P. A.," care this Journal.

WANTED,

Chief solicitor to direct other solicitors selling our lighting appliances to consumers in Boston. Only those need apply who are capable of earning a good salary and who can show profitable results from past work. Preference given to those with a knowledge of illuminating engineering.

Address by letter only, giving full qualifications and salary desired.

WELSBACH COMPANY,
1778-1 24 SUMMER ST., BOSTON, MASS.

PARTNER WANTED

With $10,000, to join advertiser in marketing several exceptionally good gas appliance propositions. Address, "GENERAL AGENT,"
1778-1 Care this Journal.

Manufacturers of Gas Appliances:

This Company will be pleased to receive descriptive catalogues, price lists, etc., of gas consuming appliances.

ECONOMIC GAS CO.,
1778-2 246 SO. HILL ST., LOS ANGELES, CAL.

FOR SALE,

One set of 4 purifying boxes 12 feet 8 inches by 10 feet 9 inches by 3 feet, in good condition, with centerseal and 10-inch connections. Also one American 8-foot station meter.

1771-tf YORK GAS CO., York, Pa.

(Concluded from page 17.)

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H. Mueller Manufacturing Co., Decatur, Ills..... 23

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LEATHER BELTING.

Chas. A. Schieren Co., New York City..... 24

PATENTS, TRADE-MARKS AND COPYRIGHTS.

Royal E. Burnham, Washington, D. C..... 39

Utilize Your Gas Liquor.
NO EXTRA LABOR OR OPERATING EXPENSES.
IMPROVED AMMONIA CONCENTRATOR.
About 100 in use. Write to
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MICHIGAN AMMONIA WORKS, - Detroit, Mich.

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—FOR—
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SIZE .... OF
KIND ...
WORK TO BE DONE IN GIVEN TIME.
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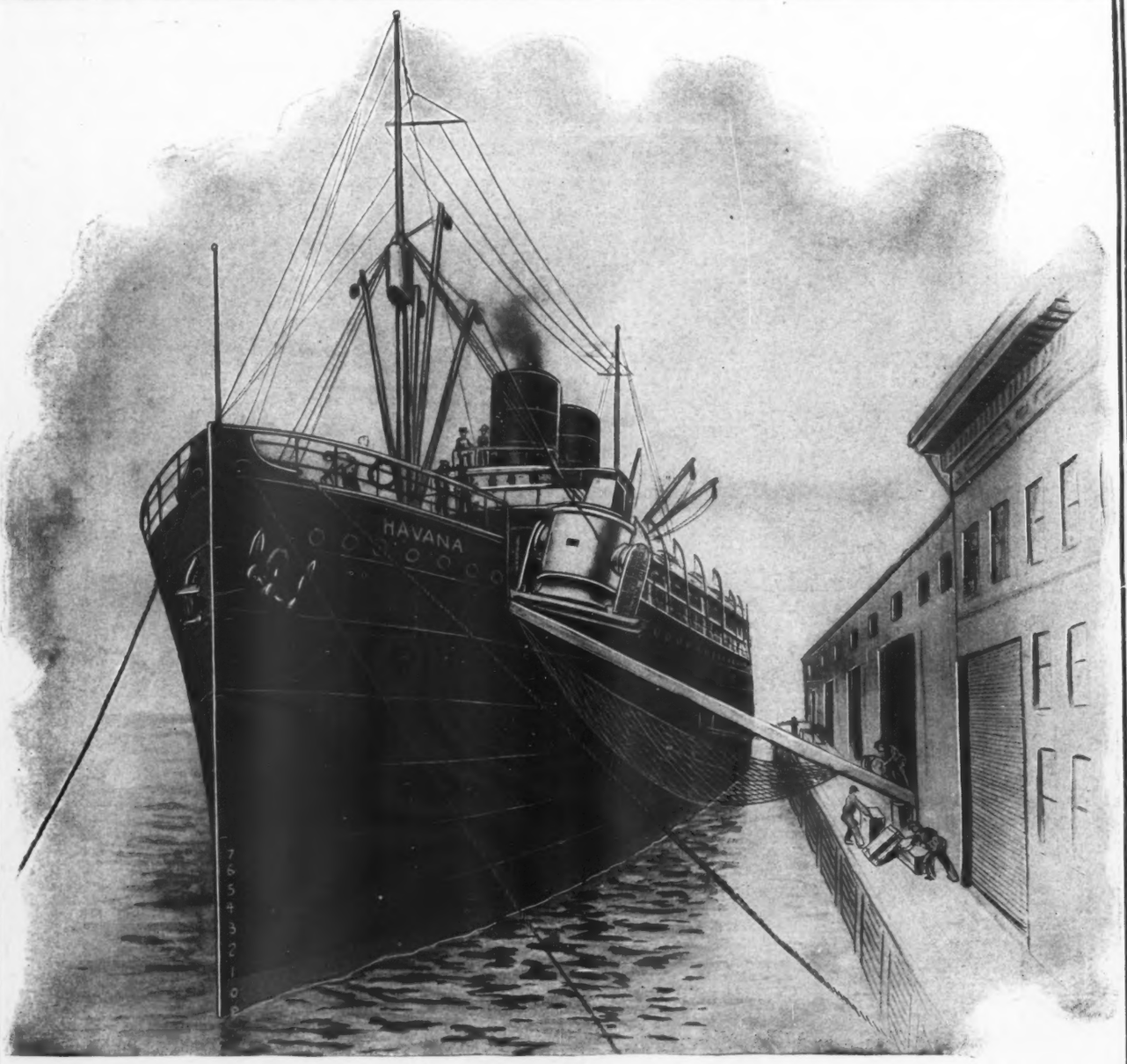

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One-half the Cost—One-tenth the Space of Old Style Wet Meters.

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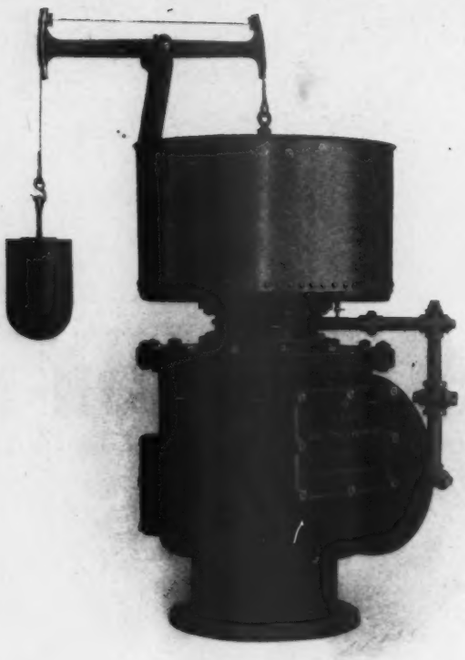
COAL AND WATER GAS APPARATUS,
EXHAUSTERS, CONDENSERS, SCRUBBERS,
TAR EXTRACTORS, WASHERS, PURIFIERS,
VALVES, CONNECTIONS,
BY PRODUCT MACHINERY,
COMPLETE GAS PLANTS.



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Hudson Terminal Building,

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"Retort House."

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HORIZONTALS AND INCLINES OF APPROVED TYPES.

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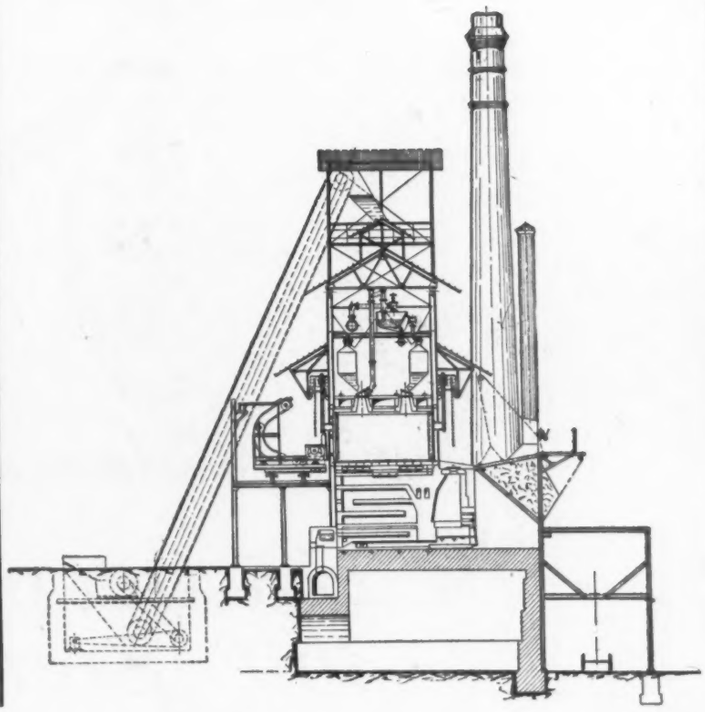

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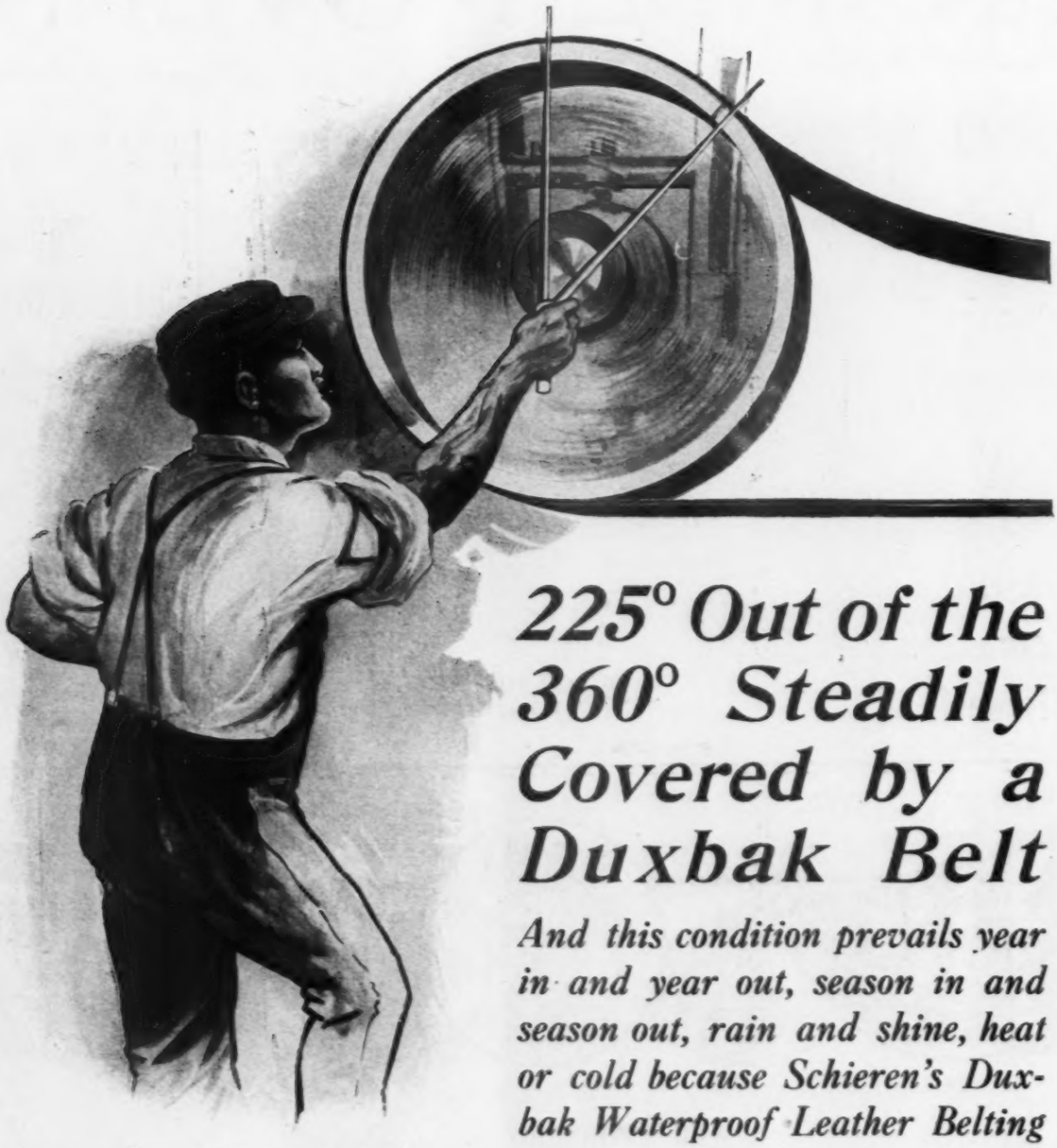

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And this condition prevails year in and year out, season in and season out, rain and shine, heat or cold because Schieren's Duxbak Waterproof Leather Belting never changes its length, strength, or pulling power through weather conditions.

There is no belting concern we know of that gives as broad a guarantee as ours. Let us send you a copy with our net price list.

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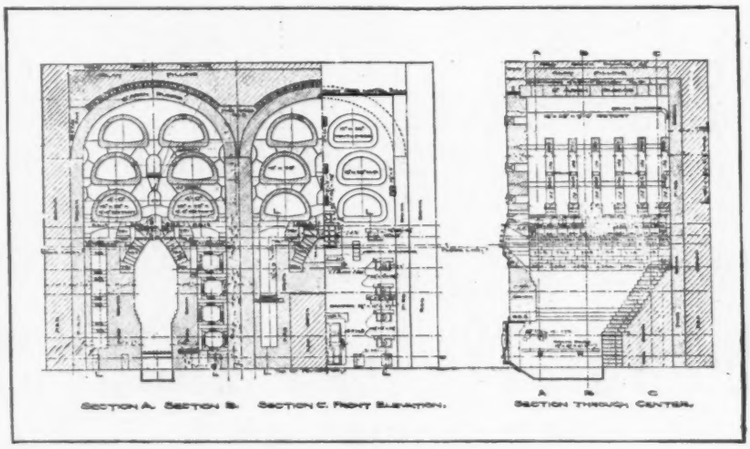
HORIZONTALS--VERTICALS--INCLINES.

Water Gas Linings.

Fiddes-Aldridge One-Stroke Stoking Machine

Charges 20-Foot Through Retorts while Discharging the Coke.

Correspondence Solicited.



The three-quarter depth bench of sixes shown will produce over 10,000 cubic feet per mouthpiece and operates on a remarkably low amount of fuel. No middle men.

We manufacture our own retorts and other fire-clay materials.

Ironwork all according to our own designs.

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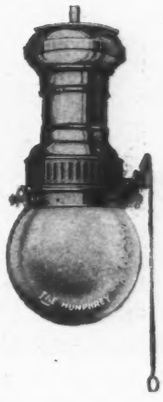

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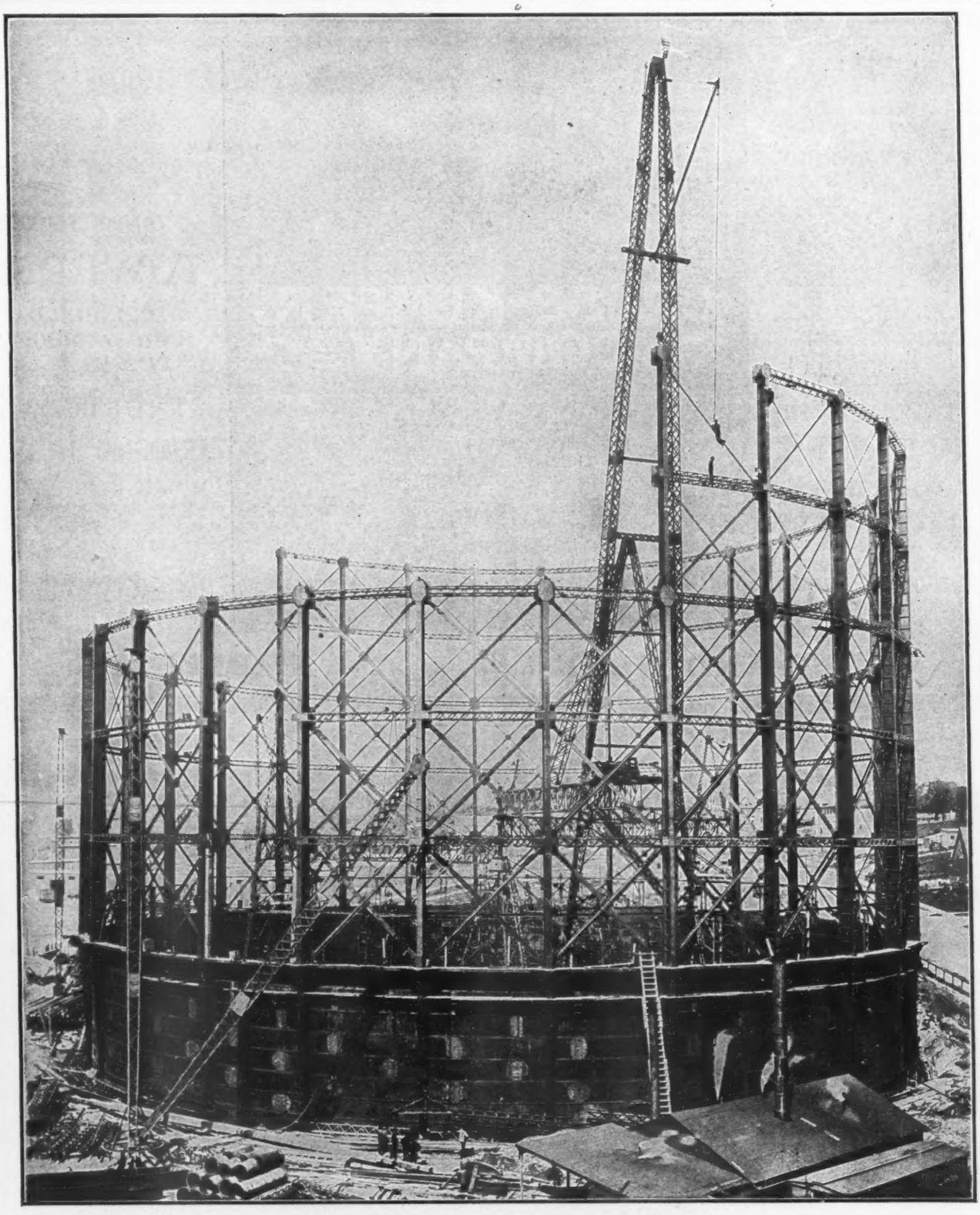

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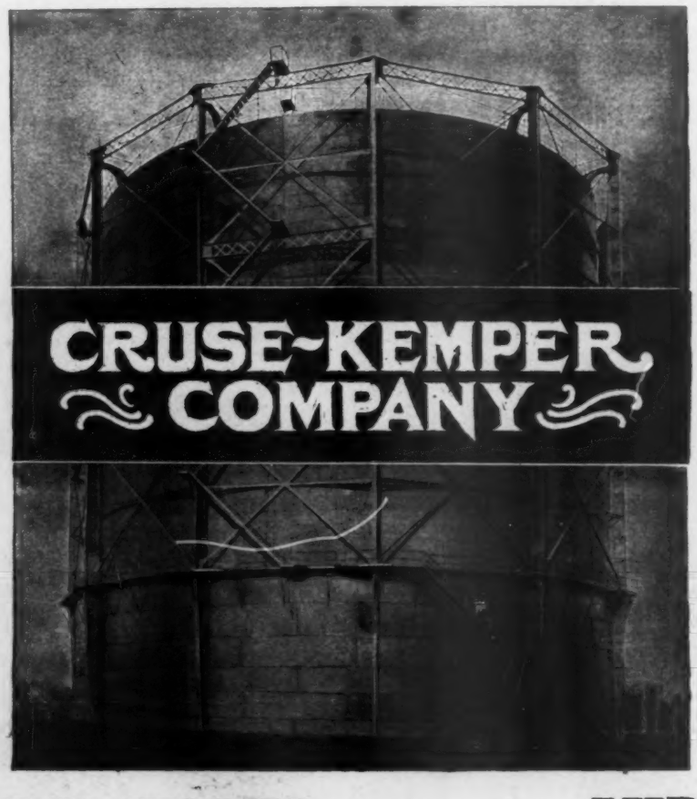

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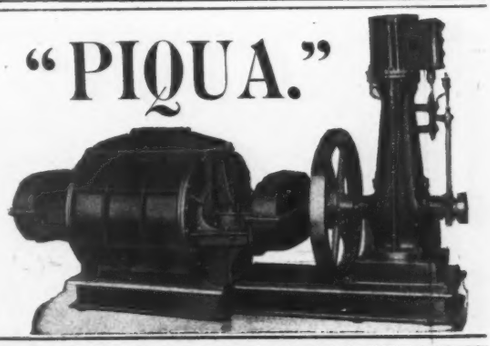

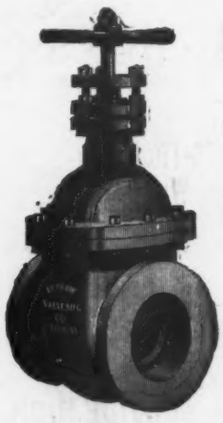

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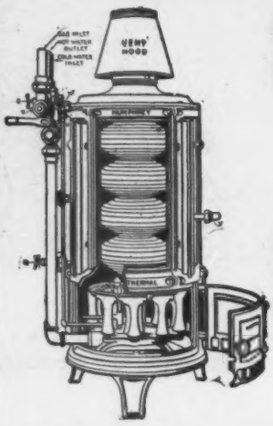

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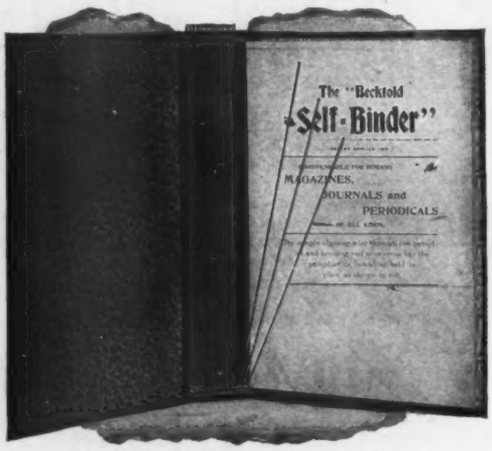

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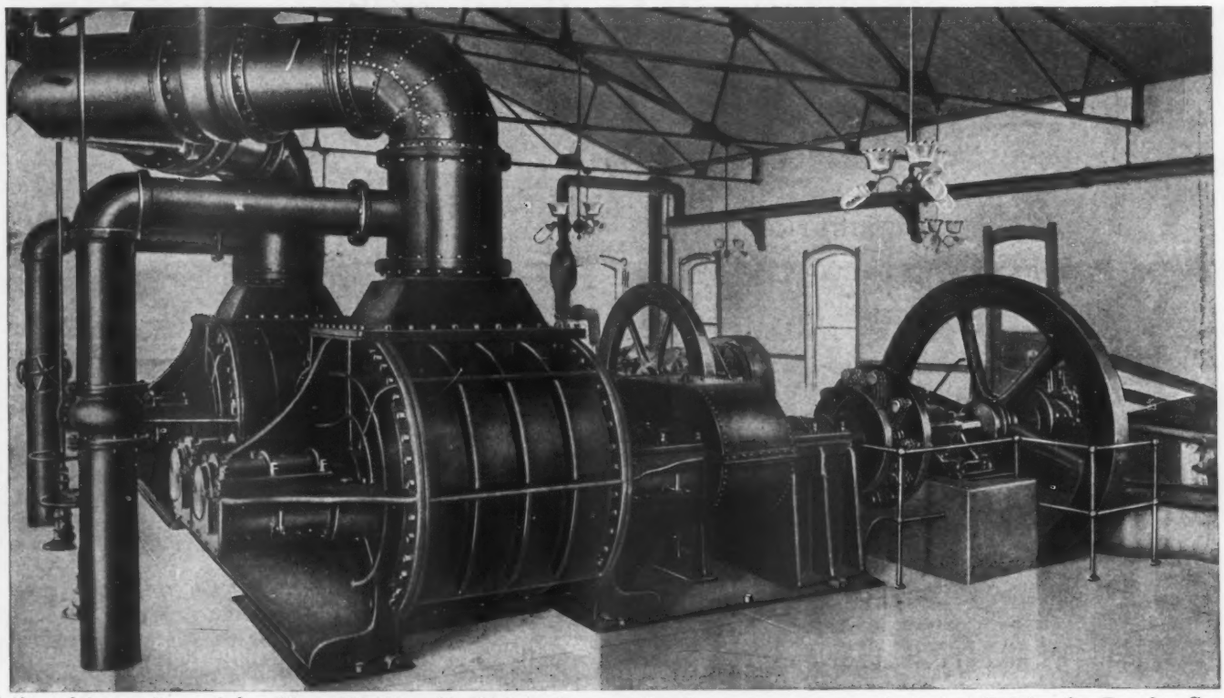

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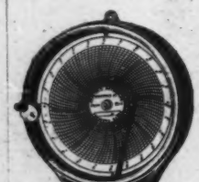

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PUBLIC LIGHTING TABLE.

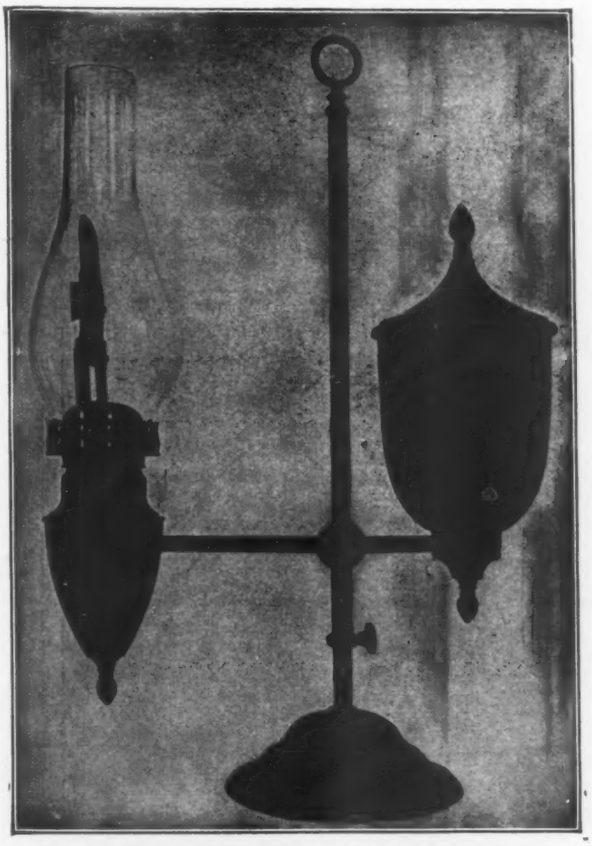
JULY, 1909.

Day of Week.	Date.	Table No. 1. FOLLOWING THE MOON. Light.	Extinguish.
Thu.	1	2.30AM	3.30AM
Fri.	2	No L.	No L.
Sat.	3	No L FM	No L.
Sun.	4	No L.	No L.
Mon.	5	8.00PM	10.40PM
Tue.	6	8.00	11.20
Wed.	7	8.00	11.50
Thu.	8	8.00	12.20AM
Fri.	9	8.00LQ	12.50
Sat.	10	8.00	1.20
Sun.	11	8.00	1.50
Mon.	12	8.00	2.20
Tue.	13	8.00	3.40
Wed.	14	8.00	3.40
Thu.	15	8.00	3.40
Fri.	16	8.00NM	3.40
Sat.	17	8.00	3.40
Sun.	18	8.00	3.50
Mon.	19	8.00	3.50
Tue.	20	8.00	3.50
Wed.	21	9.10	3.50
Thu.	22	9.30	3.50
Fri.	23	9.50	3.50
Sat.	24	10.20	3.50
Sun.	25	10.40FQ	3.50
Mon.	26	11.10	3.50
Tue.	27	11.40	3.50
Wed.	28	12.20AM	3.50
Thu.	29	1.10	3.50
Fri.	30	2.10	3.50
Sat.	31	No L.	No L.

TOTAL HOURS DURING 1909.

By Table No. 1.

	Hrs.Min.
January	212.20
February	183.40
March	173.00
April	151.10
May	144.10
June	138.50
July	145.40
August	160.30
September	180.00
October	201.00
November	216.30
December	233.40
Total, yr.	2140.30



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10-Candle Power.

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1st. It uses Standard Kerosene Oil (Pratt's Astral Oil or equivalent).

2d. It is remarkably steady. Will burn 24 hours continuously with less than 2 per cent. variation.

3d. It is much less dangerous than Pentane, which is a kind of gasolene.

4th. It is not easily affected by air currents in the photometer room.

5th. Since the lamp may burn continuously, the candle power of gas may be taken at any moment, if necessary. This insures steady illuminating power without waste of carburetting material.

6th. The first cost of the lamp brings it within the reach of even small gas works.

7th. Costs much less to maintain than a Pentane lamp or sperm candles doing the same service.

8th. Is not affected by the weather.

PUBLIC LIGHTING TABLE.

JULY, 1909.

Day of Week.	Date.	Table No. 2. NEW YORK CITY. All Night Lighting. Complete Lighting in One Hour From Time Given P. M.	Complete Extinguishing in 50 Minutes From Time Given A. M.
Thu.	1	7.27	3.07
Fri.	2	7.22	3.07
Sat.	3	7.22	3.07
Sun.	4	7.22	3.07
Mon.	5	7.22	3.07
Tue.	6	7.22	3.07
Wed.	7	7.22	3.07
Thu.	8	7.22	3.07
Fri.	9	7.17	3.12
Sat.	10	7.17	3.12
Sun.	11	7.17	3.12
Mon.	12	7.17	3.12
Tue.	13	7.17	3.12
Wed.	14	7.17	3.12
Thu.	15	7.17	3.12
Fri.	16	7.12	3.17
Sat.	17	7.12	3.17
Sun.	18	7.12	3.17
Mon.	19	7.12	3.17
Tue.	20	7.12	3.17
Wed.	21	7.12	3.17
Thu.	22	7.12	3.17
Fri.	23	7.07	3.22
Sat.	24	7.07	3.22
Sun.	25	7.07	3.22
Mon.	26	7.07	3.22
Tue.	27	7.07	3.22
Wed.	28	7.07	3.22
Thu.	29	7.07	3.22
Fri.	30	7.02	3.27
Sat.	31	7.02	3.27

TOTAL HOURS DURING 1909.

	Hrs.Min.
January	428.30
February	358.15
March	353.10
April	298.10
May	263.20
June	234.45
July	248.30
August	278.00
September	311.25
October	370.05
November	397.40
December	438.35
	3980.25
Deduct on account of 50 min. extinguishing time	30.25
Total, yr.	3950.00

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Controls and Operates the **Welsbach System of Street Lighting,**

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Uniformly SUCCESSFUL in 130 Cities and Towns.

By means of the Welsbach System of street lighting the superiority of GAS over electricity for street lighting has been fully demonstrated.

POINTS OF MERIT:

It is { Economical, Attractive, Successful, Up-to-date.

IT LIGHTS THE STREET.

Where there are no gas mains we can furnish an equally good light by our SELF-GENERATING NAPHTHA WELSBACH BURNER, and thereby supply a uniform light in all localities.

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No. 38.

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THE BIGGEST LITTLE LIGHT IN THE WORLD.

The Welsbach Junior Light is 5 inches high--consists of burner, mantle and chimney--and is attractively boxed in a pasteboard carton.

As its effectiveness and economy become better known the Welsbach Junior will supersede, for universal use in the home, the old-style open flame gas burners.

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Gives 50-Candle Power.

Uses Two Feet of Gas per Hour.

Attaches to Any Gas Fixture.

Completely Hidden from View.

Use your own globe--either gas or electric.

SMALL—EFFICIENT—ECONOMICAL.

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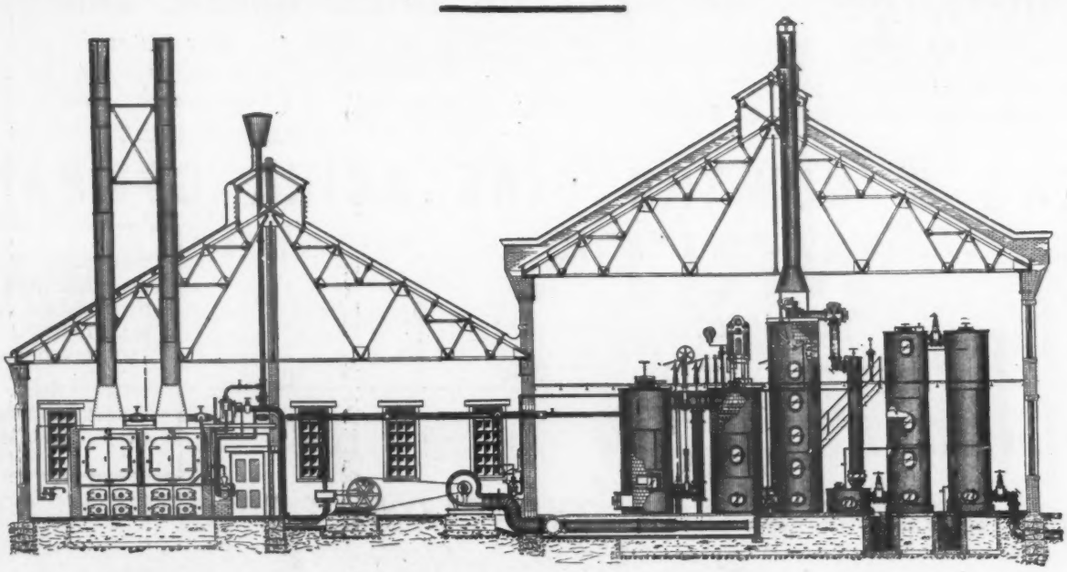

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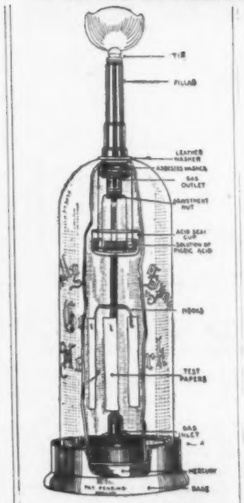

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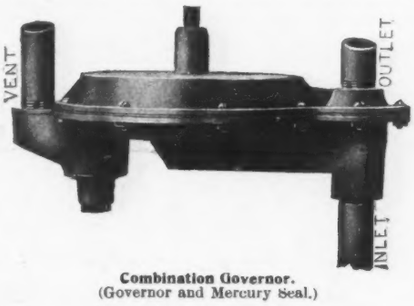

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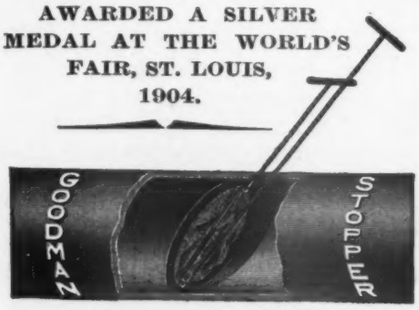

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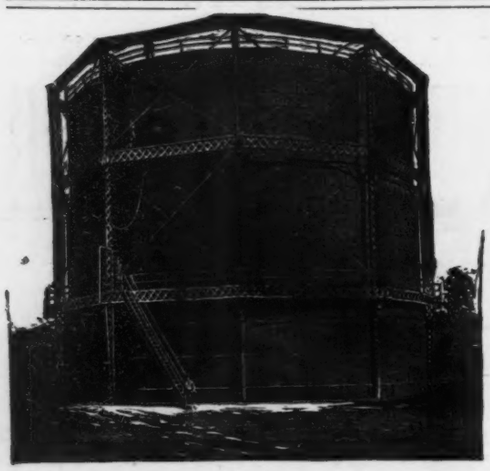

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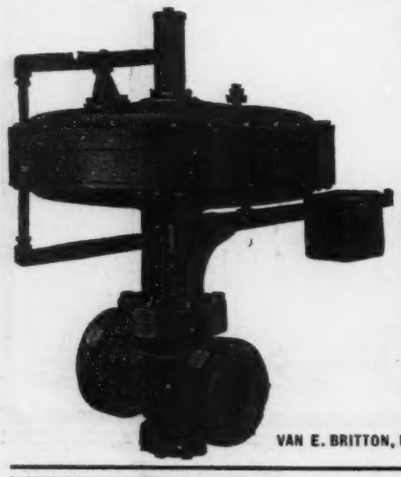

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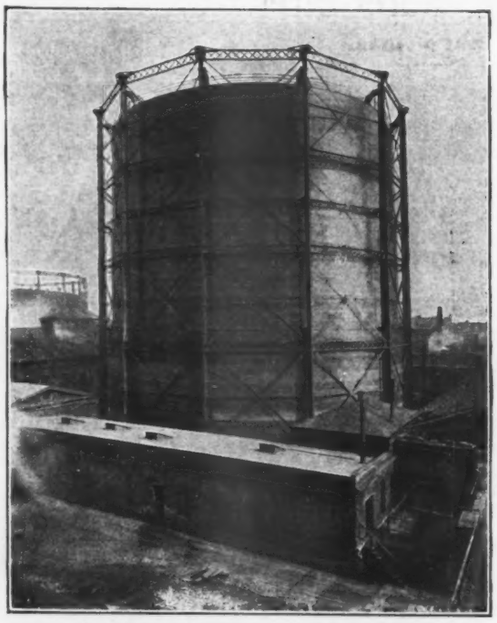

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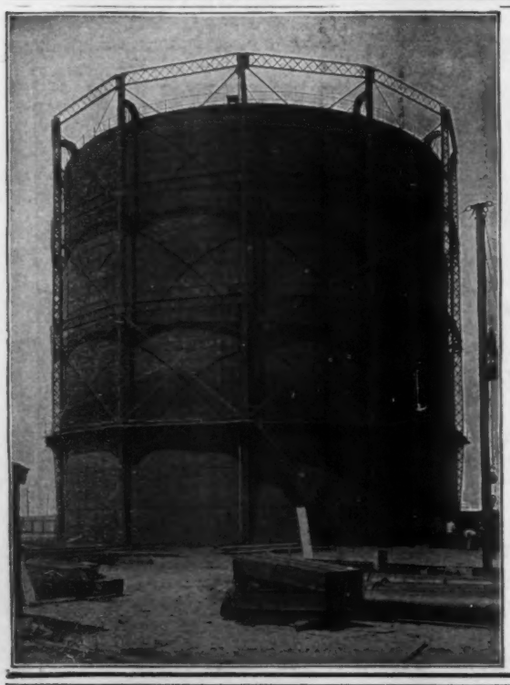

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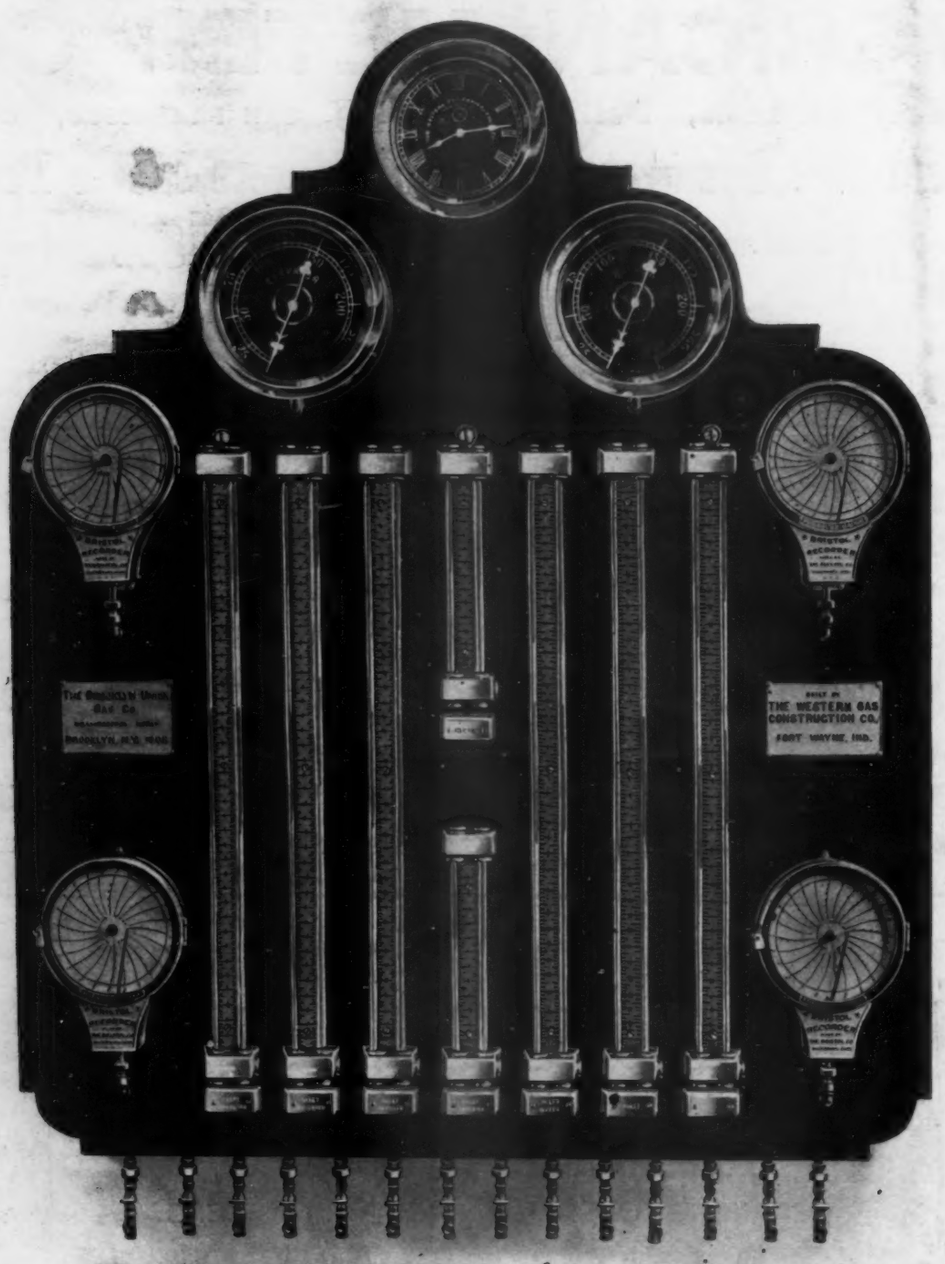

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